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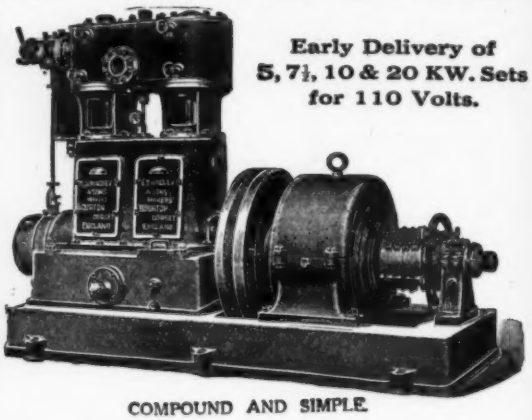

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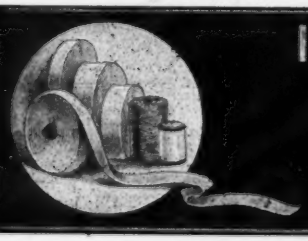

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LARGE CONSUMERS AND LOCAL AUTHORITY UNDERTAKERS.

IN certain of our big industrial towns a rather curious position is developing, perhaps one may say has already been reached in some cases, as between a local authority as the purveyor of electrical energy and a few of the manufacturers who are large consumers.

The municipal undertaker is providing the essential motive power, which may be partly utilised in the form of heat, for carrying on the particular business or industry of one or more large manufacturers.

One feature of this position is that the manufacturer is relieved of a large capital expenditure which he would otherwise have to incur in the provision of prime movers and so forth. This is an advantage to him, as any avoidance of capital expenditure without a corresponding restriction of output is advantageous, because it leaves a larger margin of available credit for his special business. It may be an advantage in respect of net income as well, if the capital charges included in the price for supply are at a lower rate than the manufacturer would have to pay out of revenue for dividends, interest, and amortisation. Generally speaking, a local authority with power to pledge the rates can obtain capital at lower rates than industrial undertakings, and even if its loan repayments are larger than the manufacturer would generally allow for depreciation or its equivalent, the total annual payments may be less in the municipal case. In this event, the manufacturer gets some advantages of a directly financial kind, because indirectly, the general body of ratepayers guarantees the interest and repayment on a substantial part of the capital employed in his business. There is a further way in which this condition of things operates to the advantage of the manufacturer. One, or a very few, large consumers naturally receive a good deal of consideration from the committee and officers controlling the municipal supply undertaking. If these few consumers provide a very large part of the revenue, the undertaking cannot be quite so independent in dealing with them as it is with small consumers. It may be supposed that for the protection of both parties contracts will be entered into covering a long term of years. But there is always either a definite period to such contracts or some period of notice to terminate, and when that period arrives, or such notice is given, the supply party will be very loth to lose a large consumer on questions of price. It will be inclined to accept a price which will barely cover its capital charges and costs rather than risk having a large proportion of its plant standing idle, earning nothing towards those charges.

Of course, this need not always cut one way. The manufacturer may be very much inconvenienced by having to put in his own generating plant, perhaps with some period of interruption of his production, perhaps with some necessity to enlarge his works, at a cost which may be very onerous. A good deal will depend upon the state and prospects of trade at the time the bargain has to be reconsidered.

Whilst many municipal authorities have men of good commercial aptitude and bargaining capacity in their electrical engineers and town clerks, it is by no means certain that they will be a match for the managers of big industrial concerns, but it is quite certain that those municipal officers have not the same direct personal incentives to keen bargaining. Also, they have to carry with them their committees and councils, on which the interests of big local concerns are generally sure of very full consideration.

There certainly seems to be some little danger of the municipal undertaking being run rather conspicuously in the interests of its big consumers in these cases.

On the other side, it is no doubt an advantage to other and smaller consumers that there should be big industrial loads with good load factors justifying the use of the most economical plant, and the most competent management. Always provided that the big consumers' price covers the proper share of capital charges and working expenses, the small consumer may be positively benefited. It might be impossible to supply him so cheaply if the undertaking were run on the smaller and less economical scale corresponding to the absence of the large industry load.

There is a certain risk in the event of a slump in the particular industry. However fair and carefully drawn up the contract may be, it is impossible to get payment from a commercial concern which has no income. Even bankruptcy proceedings in such cases are apt to be singularly unsatisfying. Something of this kind actually occurred a considerable time back when a town with one predominant industry, to supply which it had specially developed its electrical undertaking, found itself in a difficult position—as regards the undertaking—during a prolonged slump in that industry. And, of course, there is a possibility of a municipal council getting into the hands of a majority of a political party which will use its power to put pressure on its opponents, or to favour its friends, through the medium of the electricity or other undertaking. There need be no actual corruption in the narrow sense, yet a good deal of harm may be done by such political action.

It seems as though these cases call for some superior authority which will see fair play to all concerned, preventing, on the one hand, a big manufacturer taking advantage of the cheapness of municipal credit to the detriment of his fellow citizens and fellow consumers; and on the other hand, preventing any capricious action influenced by political or other motives from taking unfair advantage of a large consumer whose business is essentially dependent on a reasonably cheap supply of electrical energy.

Possibly the Electricity Commissioners and Parliament may see fit to give Joint Electricity Authorities such powers. Clearly if a Joint Electricity Authority were in command of the generating side of the supply industry over a large area there would be less risk of such dangers to either party as above outlined which may emerge under present conditions.

Apprentices and Short Time.

The case of Bell *v.* Sir W. Armstrong, Whitworth & Co., Ltd., which was recently heard by Mr. Justice Sargant, whose judgment was reported in *The Times* of July 30th, involved a question of considerable interest to employers who have apprentices in their works. To state it quite briefly, the point was this: If an apprentice is put on short time, *e.g.*, to work every other fortnight, is he entitled to be paid as for full time in accordance with the terms of his indenture? Like many another industrial problem, this has arisen owing to circumstances brought about by the war. Before and during the war Messrs. Armstrong employed a large number of apprentices under an indenture which is in a form commonly used on the North-East Coast. The apprentice is bound for five years at a wage of from 7s. to 12s. per week of 53 hours. These hours may be temporarily shortened; but an apprentice working for the full shortened period is deemed to have worked a full week. In 1918 the weekly hours were reduced from 53 to 47. All went well until the armistice, when, in consequence of the cancellation of war contracts and of their having to change over to peace work, Messrs. Armstrong found it impossible to continue to employ all their apprentices. Some agreed to their indentures being cancelled; others were sent to college for training. As regards the remainder, they were kept on, but in the middle of July, 1920, Messrs. Armstrong adopted a system of short time, paying them for working every alternate week. The plaintiff in the action was one of these. He sought a declaration that he was entitled to be paid according to his indentures for every week. The employers alleged that they were entitled to make the reduction both under the terms of the indenture and by reason of an alleged custom under which the wages of an apprentice, like those of a journeyman, were based only on time worked.

Mr. Justice Sargant rejected both these pleas, and found for the plaintiff. He said: "When one considers the object of the indenture, and the fact that both parties bind themselves for a period of five years, the one to employ and teach the apprentice and the other to serve the employer, it is impossible to read into the indenture or its schedule such a modification of the employer's *primâ facie* liability as would enable him to employ the apprentice for shorter hours and at a proportionately reduced wage." In the result the plaintiff was declared to be entitled to his wages as prescribed by the indenture for the whole period since he had worked short time. For the sake of simplicity, the above account of the case has not been complicated by any reference to another claim made on behalf of the plaintiff, namely, that he was entitled to be paid not only his 10s. 6d. a week, but all the war bonuses and additions to his wages which had been made either voluntarily by the employers or pursuant to the Munitions of War Act. It is enough to say that on this part of the case the learned judge was against the apprentice, and found for the employers.

This case will no doubt settle a large number of claims now outstanding between apprentices and employers in all parts of the country and in many different industries. We have every reason to doubt the wisdom of those who have insisted upon forcing the matter to a decision, for it must inevitably lead employers either to reduce the wages of apprentices generally or to adopt a form of indenture which will relieve the employer from making payments to apprentices for working when there is no work for them to do. We fancy, however, that the Ministry of Labour will be glad to have had the point decided as it has been. Numerous claims for unemployment benefit have been made in respect of apprentices working a week on and a week off, in respect of the week during which they are not working. Mr. Justice Sargant has made it plain that they must be regarded as earning all the time, and they can, therefore, prefer no claims for unemployment benefit.

The Lesson from the Clyde.

The announcement issued by the directors of Yarrow & Co., Ltd., that they will have to close down their works on the Clyde in November next is a serious development in the industrial situation. The decision has been reached not because of any want of faith in the future of British engineering and shipbuilding, but because, as things stand now, it is impossible to carry on with any reasonable success, and that being so, employés are given early warning so that they may seek work elsewhere. We hope that the shutting down in November may be averted, but that cannot be unless those concerned realise that commercial undertakings can only be successfully carried on when they are conducted on economic lines. It is not only the employés of Yarrow & Co. who have to take this lesson to heart or lose their employment, for there are many businesses that have been beaten about by adverse circumstances such as have affected the Clyde company, and cannot survive unless the workers recognise the imperative obligation that rests upon them to do their part to maintain the security of the undertaking from which they desire to draw their wages. As we go to press, Messrs. Brunner, Mond & Co. are announcing their intention to close down unless their men remain at work in sufficient numbers to carry on manufacturing operations. If the conditions imposed by labour are such as to continue the cost of shipbuilding or anything else at an excessive figure so that orders or purchases fall away, then where is the inducement for capital to carry on? Or assuming that there are special

orders available on condition that delivery be given within a specified period, but such delivery cannot be given because of labour's unwillingness to co-operate, are we in any better plight? The Yarrow difficulty is that cost has become excessive, and delivery to date cannot be given, because of repeated strikes, reduction of output, and demarcation disputes which have taken place in various industries throughout the country. As a matter of fact, the Yarrow decision should be an urgent appeal to that part of the industrial community throughout the United Kingdom that has not come to its senses, to do so quickly—before it is too late! Yarrows evidently believe that common sense will return, or they would hardly describe their closing as a temporary measure.

It is remarkable, after all the talk there has been during the past five or six years, on the need for removing suspicion from the relationship of master and man, that it should still be necessary for Sir Robert Hadfield to be writing, as he does in *Unity*, calling for the dissipation of the great cloud of suspicion and mistrust which is poisoning all relationships, hampering the recovery of the country. Sir Robert feels that while the workers may bow to the logic of facts and accept wage cuts, because they have no alternative, unless some permanent edifice of conciliation and co-partnership is reared on the foundation of the present agreements the peace for the present attained will prove "but a hollow truce." He believes that "renewed prosperity will bring renewed demands in all probability ill-timed and impatiently urged, and we shall traverse the whole 'vicious circle' again. Sir Robert suggests, therefore, that all employers should now meet the workers "in full and frank discussion of all the conditions of their common industry, laying the cards on the table as to the state of the order books and the conditions under which contracts may be obtained, the profits and losses made during recent years, and to discuss, with a view to arriving at a permanent scheme, the question of unemployment." A good deal of this reads very much like other matter that we have been hearing and reading for years. The time for discussion seems now to be far spent. We may go on discussing for years and years while works close down and unemployment grows. What we ought all to be doing now is *working our hardest* and bearing whatever sacrifice is necessary, in order to keep alive the industry by which we live.

Empire Patents.

We are glad to note from the official report of the work of the Imperial Conference that the important subject of an Empire patent came under consideration, and that a recommendation was agreed to by the whole Conference to the effect that a Conference of Representatives of the Patent Offices of H.M.'s Dominions shall be held in London at an early date to consider the practicability of instituting a system of granting patents which should be valid throughout the British Empire.

We trust that engineers in general and our readers in particular will do their best to see that this recommendation is not forgotten, and that a conference on patents is not very long postponed. We have often pointed out the enormous disadvantage of a British patentee as compared with an inventor in the United States. In the States, as is well known, an inventor by a single payment of £7 secures protection in every State of the Union, whereas in this country he is not only subjected year by year to a heavy and increasing tax upon his British patent, but is also obliged in order to secure protection throughout the British Empire to take out separate patents and pay separate renewal fees in each of the states, colonies, and dependencies coming under the British flag. This system may quite properly be described as a heavy brain tax, and it operates as a protective tariff against the introduction of new inventions in the Empire. The sooner a British Empire patent on the excellent model in force in the U.S.A. is adopted the better. It is a long-overdue reform, and the cost of it would be trifling compared with the advantages to be gained.

Universities and Commercial Education.

The question of commercial education at the Universities was discussed at the recent Congress of the Universities of the Empire at Oxford, and it appears that the subject was received with ready sympathy. The late Lord Balfour of Burleigh had gone to a good deal of trouble to obtain accurate information as to the work already being done in the various Universities throughout the Empire, in order that he might introduce the subject from the chair.

The principal address was given by Sir William Ashley, Professor of Commerce at the University of Birmingham. Sir William expressed the opinion that during the next 20 years faculties of commerce, or something like them, would be found in every important University in the Empire. Sir William said that he had never been ashamed of being frankly utilitarian in recommending a curriculum of commerce. Instead of aiming only at mental culture, and trusting that in some way utility would emerge as a by-product, he claimed that they should aim directly at utility, and seek to obtain the mental discipline and mental enlargement they all desired by means of such useful studies. He laid stress on the necessity of working together with the commercial community, which at present seldom sends its sons to the Universities, and would only consent to do so if it was sure of receiving most of them back again into commercial life.

We need hardly remind our readers that we have always been in favour of the adoption of commercial courses and commercial degrees at our Universities. We feel strongly that in comparing ourselves with foreign nations, such, as for instance, the Germans, we must be forced to the conclusion that they are provided with a commercial army better equipped than our own on nearly all points of education. They are linguists and economists, and although at times the similarity of phrase or method suggests too thorough a uniformity in the method of teaching, and occasionally causes them to make themselves ridiculous, it must be admitted that too frequently a German in a foreign Country is better able to push his wares than is the average Englishman in similar circumstances. Perhaps he is armed with fuller authority and freedom of action. Given these weapons in the hands of a British representative, would not his personal initiative carry him further?

There should be a faculty of commerce in every University with a man at the head who is not only versed in political economy and in the text-book side of commercial knowledge, but who has had actual commercial experience. The teaching of languages should be brought into the course, and the student should be given the choice of, say, three languages in accordance with his future intentions as to the locality in which he intends to work.

The commercial student should be taught the niceties of commercial honour and good manners, for we have not lost our pride in British commercial integrity, and he should also be trained to express himself either in writing or in speech clearly and effectively. Salesmanship is perhaps a little overdone in the United States, but it is certainly underdone in this country, and although, for our part, we attribute the unfortunate commercial position in which this country finds itself to-day, to causes quite other than inefficiency on the part of our commercial travellers, it must be obvious to everybody that such efficiency was never more necessary than it is now if we are to recover our position as suppliers of the world's markets.

From the point of view of the engineering trade it would appear to be clear that the commercial traveller, however well trained, would be practically useless unless he had some technical knowledge of the machinery and plant which he had to sell. For this reason we would suggest that the most effective way to help the engineers would be to give them such commercial training as time permits, in combination with their technical training at the Universities.

We hope this subject will not be allowed to drop.

SAWDUST AS FUEL.

MESSRS. J. SADD & SONS' TIMBER MILLS.

In view of the prevailing high price and unsatisfactory quality of the coal that is now being sold for power producing purposes, any instances of the successful use of cheap fuels should be of considerable interest and value to engineers. In this connection remarkable economies have been made in the cost of power production by the efficient use of sawdust, chips, and fine wood shavings, considerable quantities of which are produced at saw mills and timber conversion and treating works, both in this country and abroad.

Fig. 1.—Bird's-eye View of Messrs. J. Sadd's Timber Yards.

There are several ways of utilising this type of wood fuel, one of which is to burn it in boilers for steam generating purposes. An example of a steam-electrical installation consuming such fuel we described some five years ago,* but another and probably better way of reaching the same goal is to produce gas from the sawdust, which can be used to drive internal-combustion engines and electric generators, with the added advantage that provision can be made for the recovery of the tar, wood naphtha, acetic acid, &c., from the gas as is done in Sweden.

An installation of the latter type, without the recovery of by-products, however, we described about nine years ago.† It is situated at Maldon, in Essex, and is owned by Messrs. John Sadd & Sons, Ltd., English and foreign timber merchants, whose mills are illustrated in fig. 1, which was reproduced from a photograph taken from the air. The initial installation, which commenced operation in June, 1910, comprised two sets of 100-h.p. Crossley waste wood-refuse gas plant and two 100-h.p. Crossley horizontal single-cylinder gas engines direct coupled to Crompton dynamos generating electricity at a pressure of 220 volts. A view of a portion of the older part of the engine room showing the switchboards is given in fig. 2. Since that time the plant has grown considerably, and is now in a prosperous condition; the following additional plant has been installed in recent years:—

Gas Producers.—A 100-h.p. Salmon & Whitfield set, a 300-h.p. Crossley set, and a 250-h.p. Ruston and Hornsby set; in addition, one 250-h.p. Dowson and Mason and one 150-h.p. National producers were installed (to consume anthracite coal) as stand-by plant, but no occasion has as yet arisen for calling them into use.

Gas Engines.—One 120-h.p. Kynoch horizontal single-cylinder engine direct-coupled to a Crompton dynamo, one 250-h.p. Crossley four-cylinder vertical engine (fig. 3) direct-coupled to an E.C.C. dynamo, and a 500-h.p. Premier four-cylinder horizontal engine (fig. 4) rope-driving an English-Electric dynamo; a view of the valve gear of the latter engine is shown in fig. 5.

The three newer generators produce electricity at a pressure of 440 volts, and the dynamos are assisted by a battery of 112 E.P.S. and 112 D.P. accumulator cells having a 1,200 ampere-hour capacity, and being capable of delivering about 1,000 A momentarily. By this means the engines can be kept on full load, notwithstanding the exceedingly variable station output, which is characteristic of all timber mills. The engines are so closely governed that the variation in speed is not large enough to interfere with the maintenance of a steady pressure at the busbars, which desirable end is considerably facilitated by the use of very heavy flywheels on the engines.

The gas engines are water-cooled, the water being circulated through the cylinder jackets by gravity, and the cooling towers are illustrated in fig. 6. The necessity for the latter arises from the fact that the water in the tidal river which surrounds the works is not sufficiently fresh to be used for cooling purposes. A Ruston and Hornsby waste heat boiler is connected to the exhaust of the 500-h.p. Premier engine, and supplies steam to heat a timber-drying kiln; still further use is thereby made of heat which is generally exhausted to atmosphere.

The switchboards, portions of which are to be seen in fig. 2, were supplied by Messrs. Crompton & Co. The whole of the auxiliaries are electrically driven, and a 10-ton travelling crane spans the engine room.

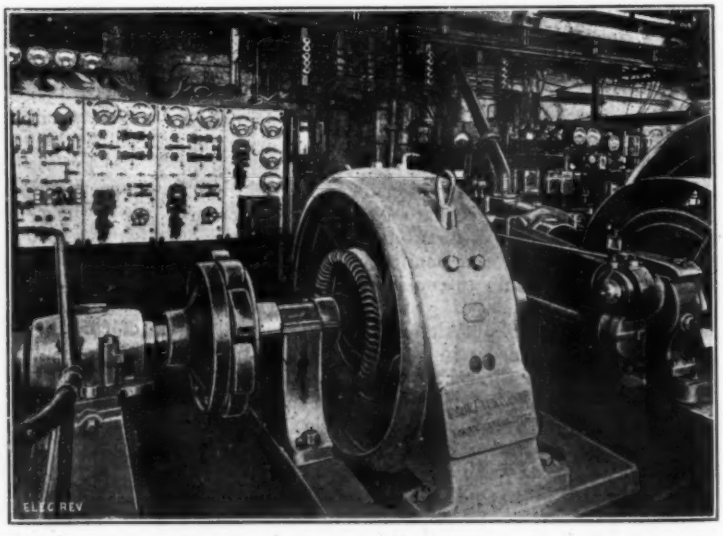


Fig. 2.—Engine Room and Switchboards.

Very little difficulty is experienced with the gas producers, two views of which are to be seen in figs. 7 and 8; they are operated entirely on wood refuse produced in the adjoining timber yards, and have given every satisfaction. The gas is first passed through a dust-collecting box over a water seal, and then up through a coke scrubber and afterwards through a centrifugal motor-driven tar extractor, fig. 8, to a wood-wool scrubber, and

* Elec. Rev., April 7th, 1916; p. 389.
† Elec. Rev., Dec. 27th, 1912; p. 1,039.

thence into the bus pipe. The gas produced is of such excellent quality that the engines will, with perfect freedom, produce well over their nominal rated output for considerable periods.

Clinker is formed, due to the presence of stones, gravel, &c., in the bark, and a certain amount of care and judgment is needed while charging when the fuel is damp (it may contain up to 40 per cent. of water), and poking is necessary to keep the fuel solid in

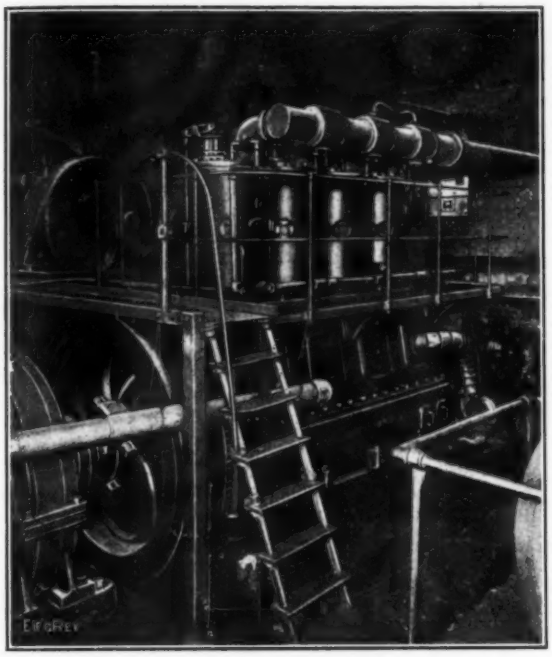


Fig. 3.—Vertical Crossley Gas Engine.

the plant. The scrubbers, washers, pipe connections, and engines are cleaned out periodically after a definite number of hours of operation; thus the plant is always

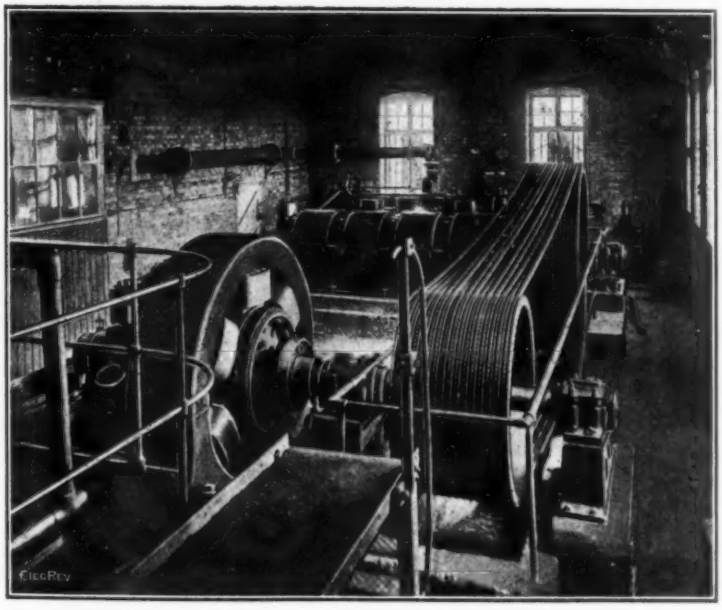


Fig. 4.—Horizontal Premier Gas Engine.

maintained in a clean state. The crude tar as produced, probably containing about 40 per cent. of moisture, is sold at a price of £1 per barrel, and the wood ash from the producers is a valuable fertiliser with a market value of £3 per ton. Whether it is economical to recover the by-products from the gas depends, of course, on the quantity produced, and as the plant is growing so rapidly such recovery will probably be undertaken in the near future; the matter is receiving consideration at the moment.

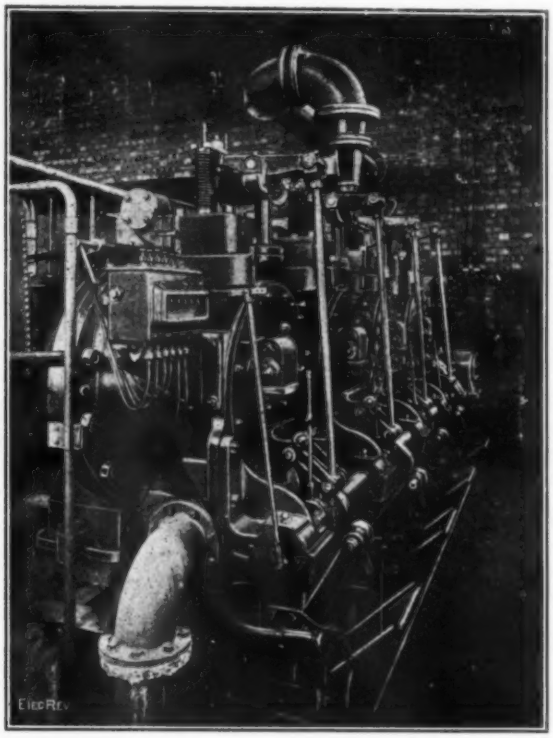


Fig. 5.—Premier Engine Valve Gear.

Messrs. J. Sadd & Sons, Ltd., besides lighting and electrically driving the whole of the machinery in their own extensive mills and yards, wherein some 50 motors are installed, aggregating 668 h.p., as illustrated and described in the previous article above referred to, also supply electricity for lighting and power purposes in the town of Maldon and the adjoining village of Heybridge. Distribution is entirely by means of overhead mains supported on wood poles, and wayleaves are readily granted by the owners of property *en route*, the supply being on the 3-wire system at 200 and 400 volts pressure.

During the twelve months ending April 30th, 1921, the maximum load recorded at the generating station was 475 kW; the quantity of electricity sold amounted to 998,364 kWh; and the fuel consumed in the gas producers to 2,876 tons—comprising 1,015 tons of scrap wood, 740 tons of sawdust, 545 tons of chisellings, and 576 tons of bark. Since January, 1921, the energy sold has averaged 83,622 kWh per month, and the cost of production has been 1.351d. per kWh at the busbars. This figure, however, is rather high owing to numerous repairs which are being carried out in order to overtake arrears in this direction, and it is anticipated that when "normal conditions" can be resumed the figure will approach 0.75d. per kWh. It should also be mentioned that energy is being supplied to consumers on much more favourable terms than are quoted in other districts.

Three shifts are run at the power house, as part of the owners' timber mills run throughout the night, and about 100 h.p. is also supplied to a flour mill continuously for 24 hours per day; it is contemplated that other local works and factories will demand supplies in the near future. Nearly 400 consumers are at present connected to the mains; their number is being added to rapidly, and the overhead mains are being extended to embrace outlying districts. Public lighting is at the moment restricted to a small area, but plans are in contemplation for lighting electrically the main streets in Maldon. Electricity for heating and cooking purposes is being favourably received in the town, and besides the usual heating apparatus, automatically-regulated incubators and service water heaters were in use so far back as 1912.

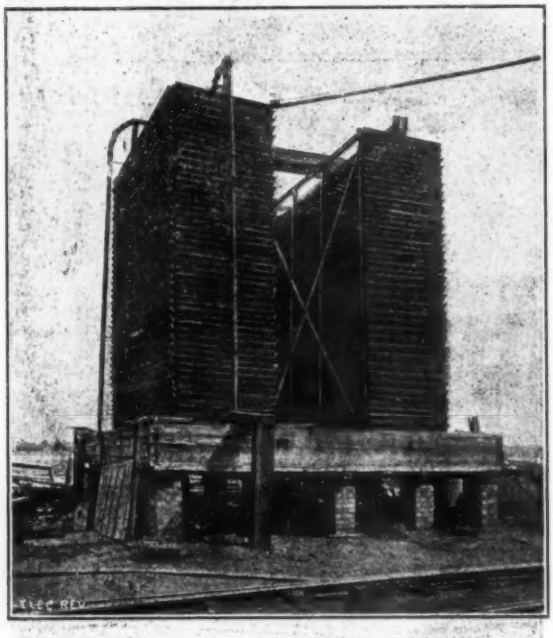


Fig. 6.—Water-cooling Towers.

Sufficient has been said regarding this interesting installation, whereby electricity may almost be said to be produced as a by-product of the timber mills, to show that scrap wood and sawdust, &c., when used intelligently is a satisfactory and economical fuel. In concluding, we have to thank Messrs. J. Sadd & Sons for their permission to visit the works and publish the foregoing article, and also Mr. M. Lonsdale, chief electrical engineer to the firm, for his assistance in the preparation of the particulars embodied therein.

LEAVES FROM AN INSPECTOR'S NOTE-BOOK.

By "Anode."

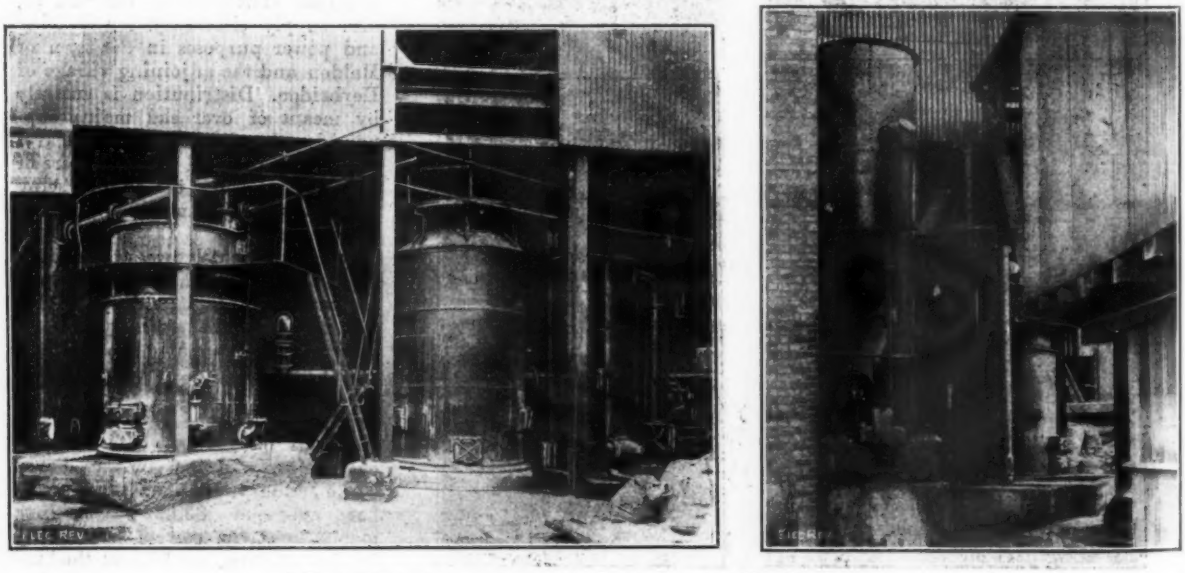
Many years ago, shortly after I had been introduced to Ohm's law and other interesting electrical facts, I attended evening classes in electrical engineering at the local technical school, and I well remember the teacher, a very clever engineer (a real one, not one of the incubated brand), getting on his hind legs and enthusing over the glorious future of electricity, and the burden of his song was:—

"In a few years the whole of the world will be run by push-buttons, which will set in operation the illimitable power of this mighty mysterious force we call electricity. You will ride in electrically-propelled vehicles. You will sail in electrically-propelled ships. You will find electric lifts to take you up and down. Your food will be cooked by its agency. When you are ill it will cure you, later on it will kill you, and then its aid will be invoked to cart you off to the crematorium, and it will then perform its last offices and incinerate you. Further, all this electrical machinery will be entirely out of sight, placed in obscure corners, economising space, and all we shall see will be the small push-button controlling and directing the mighty motors which shall do our bidding and work our will."

Not so bad for 25 years ago!

A lot of this prophecy has come true, especially the "obscure corner" part, and it is this that I intend to take as my text.

I had on my list of inspections a 1-h.p. motor at a bacon factory, and on attending there I found that the motor was bolted to the ceiling, and the only means of access was by climbing up a greasy ladder, after which I had to twist myself through an angle of 60 deg., remove a band cover, hold on, strike a match, check the clearances, get covered with fat, find the bearings badly worn, oil all over the windings, the commutator as black as the ace of spades and badly grooved, and the brushes worn down and sparking brilliantly.



Figs. 7 & 8.—Wood Refuse Gas Producers and Tar Extractor.

All this trouble was due to the motor makers, who tell the simple non-technical user that their motors work well in all positions, and once fixed it is only necessary to oil them once a month, as lubrication is automatic.

Our bacon factor looks at the pretty picture of the large works where motors are made, listens to the tale of the salesman, who descants on the large sets they are turning out for the Slocum-on-Slush Council, "3,000 volts, sir," "and every one up to Board of Trade standard," "guaranteed full cream, and that's the stuff we turn out," and thinks that the X.Y.Z. Co. are just the people to turn out his 1-h.p. motor.

Accordingly, in it goes, it is stuck up in the ceiling, and is a nine days' wonder; the most intelligent man in the shop is detailed off to look after it, which he does daily, flooding it with oil, and fancies he is well on the way to becoming a second Edison. Then he gets tired of it, a fuse blows, the factory is stopped for a day, the insurance agent blows in, effects an insurance, and henceforward it is my funeral. I point out all the defects, instruct the attendant how to look after the machine properly, adjust the brush position, and so it goes on till the motor finally breaks down.

One repairer with whom I was discussing the matter summed it up as follows:—

"The average user of an electric motor knows nothing about it, and doesn't want to, so he insures it, and rests contented. All he knows is that if it starts making a noise and things inside bump about, it is a mechanical fault; if sparks and flames come out, it is an electrical fault. You are called in, and you have to get them out of their trouble; but if you expect them to take an intelligent interest in the motor, well, you are expecting too much. The millennium is not just yet, and when it arrives we will be too busy looking after other things to bother with 1-h.p. motors."

I have come across open-type motors in boot shops, where they have been placed on the floor in just such a position that they will collect all the dust from the grinder, and it is nothing unusual to find the whole of the machine full of leather dust, resulting in the machine running hot owing to the non-conducting cover of dust with which it is surrounded, while it would have been an easy matter to have put the motor a couple of yards or more away, with a horizontal instead of a vertical drive, meaning less bearing wear and a more satisfactory drive.

In another case I came across a motor driving a circular saw, the motor being placed in a pit and covered with an extremely loose-fitting cover. The motor was covered with sawdust, and naturally ran excessively hot. The risk of fire was very great, and I had a lot of difficulty in persuading the owner to bring the motor out of the pit, fix it on the floor level, and cover it with a really good sheet-iron cover. In this case the motor was fixed in the pit in order to save floor space, but I venture to say that what he lost in floor space by removing it, was more than gained by the extra facility given for examination, and the lengthening of the life of the motor through cooler running.

Motors in laundries come in for rough treatment. In one case I found an open-type machine fixed on the floor of the wash-house, and running in an atmosphere full of water vapour, and, in consequence, continually breaking down. It would have been an easy matter to place the motor in a small building outside the wash-house, where the conditions would have been more suitable, but the owner grudged the small expense he would have been put to, and preferred the continual losses through stoppage of the plant, which amounted to a large sum yearly.

Motors in breweries also cause a lot of trouble, which could easily be avoided by installing machines suitable for the work.

Totally-enclosed motors should be put down in all cases where water vapour is present, and the use of semi-enclosed or open motors should be limited to situations where the atmosphere is normal and free from dust. It is quite an easy matter to have the windings coated with acid-resisting varnish, and if its use were universal throughout breweries, &c., electrical trouble would be greatly minimised.

The same remarks apply to all chemical works, and tanneries also run their plant under equally bad conditions.

It must not be imagined that it is only in the case of small users of electric power that we find these instances of neglect.

In many instances I have found machines placed in bad positions simply because that happened to be the easiest way of accomplishing the task, no regard being paid to the question of efficiency and upkeep, and this is especially noticeable in collieries. I am not now speaking of motors fixed in temporary positions, as in some circumstances it is essential that a motor be put to work at a moment's notice, and even if it has to run under continuous overload it has to go through with the work, pending one more suitable being obtained. The instances to which I refer are those of permanent pumping plant, one case being that the motors and pumps were fixed at the lowest part of the mine, with the result that when a breakdown occurred to two of the three sets, the whole of the pumps were flooded, whereas had the motors been brought 10 ft. higher up there would have been a storage capacity which would have enabled considerable repairs to be carried out before water trouble was threatened.

And the moral: Leave the job to engineers, real ones, not incubated ones!

RUSSIA'S ELECTRIFICATION.

Ambitious Schemes and Considerable Progress.

A Russian paper states that for the purposes of the electrification of the industrial establishments of the Vladimir Government, the Tiekoff and Pistzoff marshes will be turned to account in the first place, after which others will be exploited for the purpose of yielding fuel to drive the machines. These marshes are all of considerable extent and of useful depth for fuel production. On the Tiekoff marsh it is intended to install during the next three years 60 peat presses, and to extract at the rate of 6,000,000 poods of peat per year. This quantity will supply the electrical station to be installed, the buildings of which are now in process of construction near the Rubisky marsh. It is intended to install three turbo-generators of 60,000 kW. It is intended also to follow on with an electric station at the Pistzoff marsh. The idea is to connect all the industrial centres of the Government to this central station, and such would include the district of Ivano-Vosnesensk, Schuya, &c. The extension of the distribution from these stations to the agricultural establishments of the Government is likewise contemplated.

In the current year on the construction of the electricity generating station on the Rubisky marsh, the construction of a full gauge railway connecting it with various centres, the length being 153 versts, will be proceeded with. A temporary electric station has been installed to light the establishments on the Rubisky marsh, where a sawmill will be erected, also engineering shops, workmen's dwellings, and general service buildings. The utilisation of the above electric stations is expected to effect a saving of 80,000 cubic sazhens of firewood per annum.

Although determined efforts are being made to effect what are called capital repairs in the Petrograd electric stations, it has to be admitted that delay has occurred owing to scarcity of competent labour. There is also great difficulty in obtaining some parts and materials, which have failed to be delivered, although ordered in apparently good time; and it was feared that if the necessary steps were not at once directed towards obtaining these goods, the repair work then in hand would have to cease by August 15th. In some cases the workmen have formed Cartels or group unions and addressed themselves to overhauling the turbines, and reinstalling them with considerable success.

It is announced in one journal that a concession granted to a large Scandinavian group for the exploitation of submarine cables between Russia and Denmark, Japan, and China has been confirmed.

The telephone system of Tula is said to be completely ruined, and in its place a new underground double wire system is being laid. The work is proceeding with great energy, about 1,000 men being engaged on it. The number of subscribers expected, when the work is completed, is 1,500, or approaching three times the number that was connected to the old system.

It is hoped to start the Kashirsk electric station in the month of November. The plant already installed represents 10,000 kW, but this is to be increased to 60,000 kW. The machinery will be run on coal from the Moscow district.

An electric station to supply the Utkin factory, Petrograd, is being completed. The present power is 10,000 kW.

The Russo-French Metallurgical Works, Petrograd, were to deliver a first consignment of electric ploughs by the first of August.

WORKING CONDITIONS IN FACTORIES.

Report of H.M. Inspector of Factories.

From the report of the Chief Inspector of Factories and Workshops for the year 1920 * (the electrical inspector's portion of the report was abstracted in our issue of August 5th) we learn that notwithstanding the trade depression during the year the number of registered factories increased by 4,610 to 140,064, while workshops continued to disappear, their number being 141,971. The total number of persons employed in all factories in 1919 was 6,127,706—*i.e.*, 2,157,783 females and 3,969,923 males. Thus when practically all the females employed as substitutes for men during the war period had given up their occupations, there were employed in the factories alone 430,000 more females than in 1913, while at the same time there were 350,000 more males.

Rather fuller accident statistics are given than in former years; they show that the total number of accidents reported in 1920 was 138,702 [1404], † of which 403 [23] were due to electricity. The total number of accidents in electrical generating stations was 531 [7] of which 59 [4] were due to electricity, and in electrical engineering 2,442 [6], of which 42 [2] were due to electricity. During the year 350 fires were reported, of which one was in a generating station and six in electrical engineering works.

During the year the Employment of Women, Young Persons, and Children Act, 1920, and the Women and Young Persons (Employment in Lead Processes) Act, 1920, became law. The Departmental Committee on Factory Lighting that was appointed in 1913 and issued its first report in 1915, when its work was suspended owing to the war, resumed its investigations towards the end of the year, but owing to the urgent need for economy its inquiries have since been restricted. It has, however, assisted the department to prepare a pamphlet on factory and workshop lighting, and an important memorandum on artificial respiration in cases of electric shock was issued during the year. It is proposed to reorganise the inspectorate so that the men's and women's sides will be amalgamated and women inspectors will become eligible for all posts. The number of districts is to be increased from 62 to 88, and four additional electrical inspectors are to be appointed. Though the changes will involve considerable redistribution of the staff, the total will remain about the same.

Crane Accidents.—The grave character of many of the cases arising from overhead cranes is noticeable. Certain types of accidents which are known to be preventable by fencing or slight modification in the design of the mechanism responsible for injury, still continue to occur up and down the country. Investigations show clearly that cranes are not examined sufficiently often nor carefully enough. Further, repeated failures suggest that the original safe load should be reduced as the crane increases in age, to allow for the factors of fatigue and deterioration of material generally. The whole subject is one of special importance, for not only is the total of accidents high, 2,379 in 1920, but many prove grave in character—no fewer than 109 terminated fatally. The use of cranes is increasing, and the modern tendency is towards higher speed in hoisting and lowering, and (in overhead cranes) acceleration also in speed of travel.

Abrasive Wheels.—It is reported that a hitherto unsuspected cause of excessive speeding-up was revealed by the bursting of periphery wheels driven by compound-wound electric motors. The shunt circuit breaks, owing to the fusing of the shunt winding. The motors thus become series wound and a greatly increased speed results under "no load" conditions. Means of prevention are now under consideration.

* H.M. Stationery Office, Kingsway, W.C. 2. Cmd. 1403; price 1s. 6d. net.

† Principal numbers are those of accidents; small figures are those of fatal accidents only.

Explosions.—An explosion in an india-rubber factory, which caused the deaths of seven men and injury to nine others, is thus described: Cotton fabric impregnated with a solution of rubber in naphtha and rolled into bundles is taken to the naphtha recovery plant, where the excess of naphtha is removed, before being taken to the steam heating frame. Owing to an oversight, a roll of solutioned fabric was conveyed directly to the warming frame from the spreading shop with the result that, when a certain amount of cloth had passed over the frame, a violent explosion took place. Elaborate precautions are taken with regard to ventilation and the prevention of fire; the place is lighted electrically, safety globes being placed round the lights, and the machines are operated electrically. It is presumed that the explosion was caused by a spark from the calender motor or by a spark of static electricity generated by the passage of the cotton fabric over the steel frame of the warming machine, and shows the necessity for taking all possible precautions to prevent sparking in an atmosphere charged with inflammable vapours.

A curious accident occurred in a large boiler shop where 16 smiths' hearths received their air supply from an electrically-driven fan. The air blast was fed to the coke fires through pipes from a main. While the fires were in full blast the fuse "blew" on the fan motor circuit and the fan stopped. The heat of the fires then caused a reverse current in the pipes, and air was drawn through the fires forming carbon monoxide as it passed through the hot fuel. When the blast came on again the oncoming air formed an explosive mixture with the carbon monoxide and this ignited at one of the fires. The resulting explosion ruptured the blast pipes, but nobody was hurt. Safety flaps have since been fitted in the blast pipes.

Dangerous Trades.—The high incidence of lead poisoning in the electric accumulator industry—48 cases in 1919 and 47 in 1920—emphasises the need for the most meticulous attention to the detailed observance of the statutory precautions, and suggests, indeed, the desirability of an even higher standard of working than the code demands. A very considerable expansion of the accumulator trade has followed the great development of the motor industry. The Women and Young Persons (Employment in Lead Processes) Act, 1920, it should be noted, forbids—section 1 (*e*)—the employment of women, and young persons of both sexes, in mixing and pasting both in manufacture and repair of accumulators.

Some of the works under the code are quite small. Several came into existence during the war, when the premises taken were in many cases far from satisfactory for the purpose. Considerable pressure had to be put on some of the firms concerned to ensure the necessary remedies, or failing this, the closure of the works was ordered.

The reports show that the standard of compliance varies considerably, and the following notes indicate the requirements which were found to be the most neglected:—

Regulation 3.—Constant maintenance of floors of pasting rooms and those in which dry compounds of lead are manipulated in moist condition, and daily hosepipe washing of same.

Regulation 4.—Provision and use of suitable receptacles for lead ashes and old plates. The receptacle for the dross and ashes, from which most harm is to be feared in the lead melting process, should be under exhaust.

Regulation 5.—Any manipulation of dry compounds of lead, whether in connection with paste mixing or otherwise, except when carried on in a dust-proof machine, must be done under the prescribed conditions of exhaust ventilation. Such manipulations would include, for instance, scooping from barrels of lead compounds; weighing of lead compounds; breaking-up and remixing of unused dried paste. It has been noted that a narrow view of the scope of the regulation is sometimes taken, and that such processes as mentioned are carried on without the specified precautions.

Regulation 15.—This requires the daily cleansing of floors and benches, and is often seriously neglected. Cleansing should be done with the scattered lead material properly moistened, or a suction cleaner should be used.

Some important health matters are not specifically dealt with by the code, but under the more general requirements of the Acts. Thus, the small power-driven saws used for plate trimming should be provided with exhaust ducts. Filing and brushing operations should also be carried on at benches provided with localised exhaust. Sheets of brown paper or cloths are used in some places in connection with paste operations, *i.e.*, between the pasted plates. It is important that the risk from the paste which dries on these should be recognised. The paper is thrown away. In either case proper receptacles are required.

Suitable warming arrangements should be provided at the fresh air inlets to the room to ensure that the ventilation will not be interfered with in winter time, and that the workers will not block up the inlets in order to prevent draughts.

Special inquiries have been made during the year in connection with the overloading of cranes, and although there is very little evidence to show that deliberate overloading often occurs, a great lack of care is exhibited by some firms. Electrically-driven cranes are very liable to be over-loaded, owing to the crane drivers and others interfering with the fuses in the hoisting motor circuits.

The increased use of electric lighting has effected a considerable improvement in the standard of lighting provided on ships under construction or repair and also in the ship-

yards generally. Very few complaints have been made as to the inadequacy of lighting.

Lighting in Factories and Workshops.—There is evidence that the importance of adequate and suitable illumination is being increasingly recognised by employers, and that a high degree of brilliancy, not only on the field of work but in the general lighting of the room, is appreciated by the workers. Improvements are reported both as regards natural and artificial lighting; there is reported, too, from all parts a wider adoption of electric lighting in substitution for gas.

The most obvious defect in many new installations is that of *glare*, chiefly due to the increased use of gasfilled lamps which are substituted for the ordinary vacuum electric globe, and used with inadequate shades. The rival claims of general diffused lighting and localised lighting confront the employer. The former is gaining in favour for factory use. Localised lighting is the more expensive. High-power lamps increase the illumination for the same consumption of electricity, and enable the employer to provide for the general illumination of his workrooms an intensity of light previously restricted to the small area of an individual operator's work. Such general lighting is in practice usually obtained by means of gasfilled lamps distributed over the room at very varying heights with shallow shades, or far too often, without any shade whatever. The "indirect" lighting obtained by means of an opaque bowl, which causes the whole of the light to be received by reflection from the ceiling, is more suited to restaurants and places of entertainment than to factories. For processes requiring brilliant light on the field of work a combination of general and of localised lighting seems to be the most suitable.

While progress in lighting is reported by the inspectors, the other side of the picture is unfortunately equally prominent, as are also defects in both natural and artificial lighting. In this connection the result of investigations made by the Fatigue Research Board on output in silk weaving is of special interest. It was found that "every unnecessary hour under artificial light means a direct loss of production and makes the task of the worker more difficult than it need be." It was proved that "under artificial illumination production falls even if electric light of sufficient intensity is provided. The magnitude of the fall is of the order of 10 per cent. of the daylight value of the output."

Seeing that daylight is so superior to artificial light, and, moreover, saves the cost of an illuminant, it is surprising that more care has not been taken to admit it into workrooms as fully as possible, and that so little use has been made of devices whereby daylight may be secured or conserved. A word of caution may not be out of place, in view of reports of artistic "colour schemes" for factory walls, adopted with the object of relieving the drabness of industrial employment, namely, that care should be taken to choose colours which will not absorb the light.

In some industries daylight is essential for colour work, and use is being made by some firms of "artificial daylight," when natural light is not available. The effect produced is reported to be highly satisfactory to those who have installed the necessary fittings, but the expense involved, owing chiefly to the amount of electric light necessary to obtain a sufficient illumination, is too high to permit at present of more than a very restricted use. The principle in each case is that of reducing the red and orange rays which preponderate in artificial light, until they bear the same proportion to the blue-violet rays as in daylight; the result is reached by different methods.

The relation between the safety of the workpeople and the efficient lighting of every part of the factory has not yet been sufficiently appreciated by many employers.

The many and varied problems involved in industrial lighting are to receive further consideration in the coming year.

(To be concluded.)

Swedish Transformers for Russia.—About a year ago an order for eight transformers, representing a value of over 1,000,000 kronen, was placed with Luth & Ropens Elektriska A.B. by M. Krassin and Prof. Juon on behalf of the Centrosojus. Three of the transformers were delivered some weeks ago, two have just been shipped, and the remaining three are expected to be ready by the end of the present month. Payment for the transformers is said to have been made in Swedish currency. The transformers already completed have been inspected and approved in Stockholm by Soviet experts, and four of them are destined for erection at Kaschira, about 43 miles from Moscow, while the others are for a step-down station in Moscow. There is a steam power station at Kaschira where local lignite is used as fuel. The generation pressure is 2,800 V, which is raised to 115,000 V, and about 12,000 kW is transmitted to Moscow, where the pressure is reduced to 1,000 V. The weight of each transformer, including oil, is stated to be about 29 tons; they have been constructed on the mantle type, which possesses great power of resistance against electrical and mechanical strains, and they are the first which have hitherto been constructed in Sweden for this high pressure.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Mosaic Fittings.

A type of fitting which is quite new to the British market has been introduced by the Mosaic Fitting Co., Ltd., of 31, Newman Street, W.1. It is made in the shape of bowls, globes, or shades, in mosaic patterns composed of variously

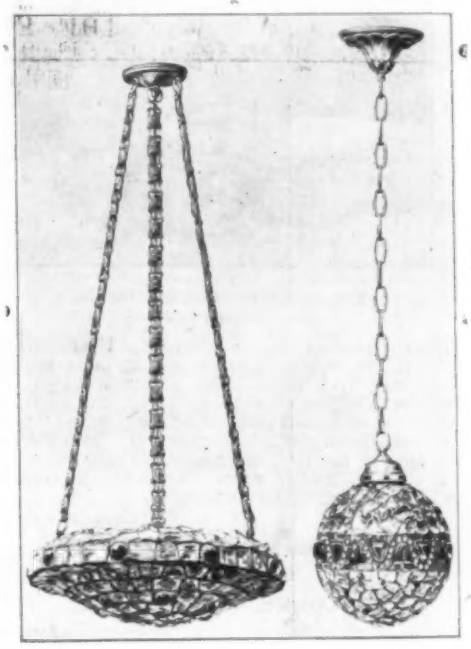


Fig. 1.—Mosaic Fittings.

shaped pieces of coloured glass, which, we understand, are put in position whilst molten or plastic. Obviously, very beautiful and artistic designs can be produced in this way, and the light passing through them gives very pleasing effects. Examples are shown in fig. 1, but a black and white reproduction naturally fails to do justice to the originals.

A Traffic Regulator.

Mr. Alexander Zarky, 930, W. Temple Street, Los Angeles (Cal.), U.S.A., has sent us some particulars of his traffic-

Fig. 2.—Traffic Regulator.

regulating device which, he states, has already been employed with success. This regulator consists of a pedestal mounted on a box. On the top of the pedestal is a glass globe, con-

taining a lamp, on which are painted four circles—two red ones bearing the word "Stop," and two green ones in which the word "Go" appears. The box at the pedestal's base contains dry cells or accumulators. Fixed half way up the pedestal is another box containing an adjustable clockwork-operated timing device which operates small contactors which are housed in the column between the clockwork box and the globe. The globe does not revolve but turns and reverses

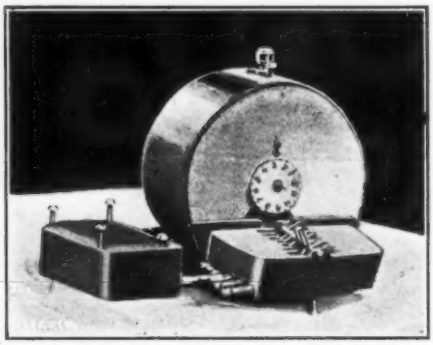


Fig. 3.—Clockwork Mechanism.

in periods depending upon adjustment. If desired, the one control can be employed for operating other synchronised lights by means of relays. The column is shown in fig. 2. Fig. 3 illustrates the clock mechanism. The contactors are seen mounted on a shaft revolved by the "second" movement of the clock; these dip into mercury in which the terminal screws, seen at the side, are immersed. The inventor states that if overhead trolley wires are already in existence the device can be inverted and suspended.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Oil Consumption and Prices.

In your issue of July 29th we note that your correspondent, Mr. E. F. Butler, refers to the lubricating oil consumption of the Vickers-Petters oil engines. A comparison is made of the performance of a 1,000-h.p. engine using, according to the statement in the *Daily Mail*, 4,000 gallons of lubricating oil in the course of a year's working, and a 1,000-kW turbine using 350 gallons.

The Vickers-Petters oil engine is made in sizes up to 500 b.h.p., and within that range great economies can be shown in comparison with steam engines. It does not, however, profess to enter into competition with large turbines such as the 1,000-kW set referred to by Mr. Butler. A turbine certainly has the advantage of only requiring to make up for lost oil due to leakage and atomisation.

As a matter of fact the new Vickers-Petters oil engine is lubricated on a patent system which effects a great economy of oil, and makes the comparison favourable with Diesel, horizontal, and other types of oil engines. The lubricating oil consumption on an average amounts to 0.006 pint, or, say, 3 grams per b.h.p. per hour.

For Vickers-Petters, Ltd.,
G. B. Petter, *Director.*

Ipswich.
August 12th, 1921.

Country House Lighting Plant.

Mr. Taunton's very able and interesting article in your last week's issue shows some of the disadvantages of automatic and semi-automatic electric lighting sets, but I do not think he gives enough emphasis to the fact that even the largest of these sets is too small for quite moderately sized country houses. The average owner, usually, has no idea how much light and power he needs until the plant has been installed; then, as his ideas and experience increase, he proceeds to add lights and accessories to the installation without any thought as to the size of his plant. This becomes overloaded and, finally, "gives up the ghost," greatly discrediting electric light in the neighbourhood. The only way to avoid this is to install ample engine and dynamo capacity at the beginning. The battery is not so important, as it can be worked continuously at full load with less harm, in the long run, than an oil engine.

If the 3-b.h.p. set, which Mr. Taunton favours, is viewed from this standpoint, it does not show up very well, and I should doubt very much if it would be adequate for a 50-light installation.

Personally, I have found that an installation, comprising a low-speed horizontal oil engine, a dynamo, battery, and switchboard, costs very little more than these 3-b.h.p. sets. The low-speed set is certainly more difficult to start, but it can easily be run by unskilled labour. Have these small semi-automatic sets been installed for a sufficient number of years to enable a satisfactory estimate of their reliability to be formed?

C. E. Atkinson.

Bexley.
August 15th, 1921.

The Electrical Trades Union and Non-Union Labour.

Having read with annoyance the attitude taken up by the above Union in London with regard to connecting up installations carried out with non-union labour, the writer is wondering how the organisation (or disorganisation) gained its great power. By experience he has proved that it certainly isn't due to the practical qualifications of the average member of the E.T.U. I am told by several of its members that they joined up for peace, but not by choice, and I believe that that is exactly the position taken up by the minority of really practical electricians in the E.T.U. I am also surprised that no trade test is carried out before admitting a prospective candidate or "would-be" electrician as a member, and that anyone who comes along (or is dragged along) with the slightest knowledge of electrical work is admitted a member. My information has been furnished by so many members of the Electrical Trades Union that I have no reason to doubt it. I also think, like the Electrical Review, that sooner or later the meddler burns his fingers, and not only will the E.T.U., London, one day have its lesson, but the E.T.U. as a whole.

Draughtsman.

August 15th, 1921.

I have read with interest your editorial comments on "The E.T.U. and Non-Union Labour." It seems clear that there is something radically wrong with the methods adopted by the Union to protect its members, as it has never enjoyed the reputation and status of the A.S.E. or, later, the A.E.U. The electrical industry is flooded with all sorts of intruders who have never served any apprenticeship at all, a condition which is almost absent in mechanical engineering. Can you, Sirs, or any reader, explain why electric wiring is included in the standard recognised course to qualify for a registered plumber? It may not be objectionable for a firm of plumbers to have an electrical branch so long as it employs practical wiremen or electricians to do the work, but if electricians were to erect gas and water pipes, &c., I think the plumbers would have something to say against it. Until all this is stopped, it is doubtful if the E.T.U. will ever be able to give its members the protection it ought to.

Fair Play.

August 13th, 1921.

Abnormal Meter Records.

In line with Mr. Southgate's letter in your issue of August 5th on the above subject, I quite agree that it is very difficult to understand how the readings were taken, and continued to be taken, without the error becoming apparent and the matter cleared up.

In order to do this, more information and details are required from India, giving a complete list of readings from January, 1920.

I am, however, perfectly satisfied that a mistake was made by someone, and I gave what I considered the most likely solution on the data supplied.

One other solution did occur to me which would only be possible if the "records" were kept carelessly. That is, that the February, *1920*, readings were subtracted from the March, 1921, readings, thus giving a year's consumption, instead of one month's.

Assuming that the summer units consumed were less than the winter units consumed, the total units shown for March, 1921, would represent a year's consumption for that class of consumer. Any change of meter during the period would, of course, show up the mistake.

Still it is just possible, and it certainly would account for the error *not* being discovered by the reader who took the April, 1921, readings, assuming the mistake was made by the meter-reader of March, 1921, in line with my solution.

Pontypool (Mon.). **Theo. R. Kernick**
August 13th, 1921.

Testing and Repairing Magnetos.

A controversy upon the subject of magneto repairs is about as deep as one upon religion, and leads to the same place—usually nowhere. Robert Bosch is reputed to have termed the magneto "a box of tricks," and this would appear to be borne out by the fact that no electrical genius has ever attempted a work of any great proportions on the subject. The application of any fixed theory in magneto repair work is as abortive as the application of theory to horse-racing. It invariably comes "unstuck."

With regard to ball-race "pullers," the writer knows of two distinct designs in everyday use which are infallible, even in the case of a tight race.

Dealing with the standardisation of magnet tests, there can obviously be no standardisation of test until we have a standard magnet-steel and a standard magneto design.

Concerning armature tests, the invariable practice is a stationary test with d.c. supplied from an accumulator to the primary winding with trembler action (either a "master" tumbler or a tumbler actuated by the magnetism of the core itself). This is a totally different state of affairs from what actually happens in the armature under working conditions, where the current is a.c. with a high crest voltage which immediately collapses to zero; also where the current is solely dependent upon the strength or weakness of the magnets. Why not start from the other end and apply a h.p. current (with a spark gap) of approximately the output voltage of the machine, to the secondary winding? This should immediately detect an earth leakage. A bell test disposes of any doubt as to continuity of windings.

The slip-ring should be tested with the same h.p. current, an earth "search" lead being provided, which will immediately detect a "burn out."

The only hope for a practical condenser test is a comparative capacity test based upon manufacturers' standards, together with a "breakdown" test.

The only really positive and conclusive "running" test is to arrive as nearly as possible at road conditions, viz.: heat (approx. 120° F.), vibration, and speeds; the spark itself to occur in compressed air—say, at 100 lb. pressure.

Although an ex-Service electrician myself, and having had experience of i.c. ignition under very adverse conditions in France, I can scarcely agree with Mr. J. H. Owen, for, personally, I found the average Service electrician with a magneto in a similar predicament to the proverbial "cow with a musket."

Leytonstone, *August 14th*, 1921. **J. Perry.**

ELECTRIC HEATING BY "HEAT ACCUMULATION."*

The following notes are abstracted from a translation of a lecture by Herr Paul Beuttner to a Society of Engineers in Switzerland.

After preliminary notes on the high cost of coal in Switzerland and the possibilities of water-generated electric power for heating, and even steam raising, kiln firing, &c., particularly during hours of light load, the lecturer referred to electric heat accumulation. Accumulator stoves are now made according to three different systems: 1. Heat accumulation by means of hot water. When the water is heated to 120 deg. C. and cooled down to 40 deg., an accumulating capacity of 71,000 heat units is produced per cubic metre of accumulator storage capacity. 2. Heat accumulation in the form of steam with a 13-atmosphere pressure. When cooled down from 190 deg. to 110 deg., an accumulating capacity of 68,000 heat units is produced per cubic meter of accumulator storage capacity. 3. Heat accumulation in a solid block, heated to a temperature of 500 deg. When cooled down to 200 deg. an accumulating capacity of 90,000 heat units is produced per cubic meter of accumulator storage capacity.

The accumulator stoves constructed by Herr Paul Beuttner are based on the principle of heat accumulation. The heating stoves at present in use require during a short space of time a large amount of electricity, particularly in the morning and evening; this is a great drawback on technical grounds. The modern accumulator stove is continuously heated for 15 hours (excepting the hours during which the energy is used for lighting). The rate of use of electricity during the time mentioned is small, and the temperature available in the stove is so high that at any time meals can be cooked. Experiments which were made under the supervision of the Swiss Electrical Society proved that the following amounts of electricity were used for cooking the meals of an average large family:—

For the morning meal	0.87 kWh.
For the mid-day meal	3.00 kWh.
For the evening meal	1.95 kWh.
Amount allowed for losses in current ...	6.50 kWh.
Total ...	12.32 kWh.

In addition, water is heated at the same time for washing up. This consumption of 12.32 kWh entails a demand rate of 0.8 kW during 15 hours (outside of the time during which electricity is used for lighting). In this way it is possible to attach the accumulator stoves to any circuit used for lighting purposes. At rates charged in Zurich, the actual cost per day is 1.25 fr. where electricity is used directly for cooking the meals of an average family; where used in an accumulator stove the cost would be 0.79 fr. per day; or, assuming a night energy price of 2 cts., the cost with an accumulator stove would be reduced to 0.45 fr. These accumulator stoves can be arranged to burn wood or coal, in case the power is cut off owing to a scarcity of water or other reasons. These stoves are heated by warming rods of silicium carbonate.*

The use of electricity for heating has spread rapidly in certain industries, particularly in the case of baking ovens. These ovens are also made to use the silicium carbonate rods.

Every variety of baking oven is adaptable for electrical heating. The alterations necessary can be carried out in a few days, and in such a way that, although it is intended to use electricity regularly, the oven may be stoked with coal or wood should it be found necessary.

The electricity supply undertaking in the Lyons (France) district has now agreed to a special tariff (about ½d. per unit) for heat accumulating appliances operated during the night.

* E.D.A., No. 155.

THE THIRD FACTOR IN PRODUCTION.

A lecture which attracted considerable interest was given at Birmingham some time ago by Mr. F. L. Impey, managing director of Messrs. Moreland & Impey, Kalamazoo Works, Northfield, on "Management's Responsibility for Restriction of Output." The meeting was representative of the Birmingham branches of four staff trade unions—the Society of Technical Engineers, the Electrical Power Engineers' Association, the Association of Engineering and Shipbuilding Draughtsmen, and the National Foremen's Association—and was presided over by Mr. W. Wilson, M.I.E.E.

In the course of his address, Mr. Impey said that any attempt at better production was largely dependent upon management for success. Management he defined as the third leg upon which industry stood. Capital and labour were the other two, neither of which could achieve much unless brought together by the brains and skill of management. It had become customary for the whole of the blame for under-production to be thrown upon labour; this, however, was false, for capital and management could regulate production, whereas labour could only check it. It had been suggested that labour refrained from blaming management for its inefficiency because of its fear of payment by results, but he believed that labour's failure to blame management had been due to ignorance of the actual facts.

Efficient production, he urged, was recognised as the supreme need of industry to-day, yet everywhere plant and machinery were working wastefully and not yielding sufficient output. Though it was true that labour, if it so willed, could increase production to an appreciable extent, most of the blame for the present backward state of industry was attributable to management through lack of organisation. On the other hand, certain trade unions had, during the war, encouraged their members to restrict output, and this had been reflected in the work of large bodies of men. Capital could only overcome the hostility of labour by taking workpeople into its confidence in a just and open manner.

Mr. Impey gave twelve factors as being responsible for poor production. For seven of these, he contended, management was directly blameable; in four the blame was shared by management and labour, and only for the remaining one was labour responsible. In the first group were classified congestion of work in the factory, obsolete machinery and tools, unsuitable materials, bad working conditions, frequent changes in design, inadequate costing, and bad salesmanship. The failure in obsolete machinery was obvious, but there were many firms which could not afford to scrap their plant. The remedy lay, then, in working such machinery to the best of its capacity and making renewals gradually. Congestion of work in the factory was due to failure to take jobs consecutively, failure to collate requirements for a job before commencing it, lack of space, fixing machines in the wrong place, and overworked foremen. The cure for this was general reorganisation and the introduction of a planning office. When the planning office functioned properly it would have absolute control of the factory.

The remedy for unsuitable materials lay in efficient storekeeping, intelligent purchasing to standard specifications, and the inspection of goods on arrival.

Darkness, dirt and damp, poor floors, and narrow stairways were cited as bad conditions which proved the woeful lack of imagination among the factory owning classes, who had not realised that such a state of things not only was inhuman, but created low production and poor quality. These things could be removed and lessened at very small expense.

Changes in design, the lecturer urged, should be saved and introduced when the output was so well in advance of the selling organisation that a temporary fall in output would have no serious consequences.

As to inadequate costing, few firms could compare their actual output with the standard output that could have been obtained had the functions of management and labour been exactly co-ordinated. A cost system should serve as a test of quality and quantity, and should as far as possible forecast the future.

On the subject of bad salesmanship, the speaker thought the success of a business depended on the factory's making

* Silicon carbide ("Silundum") or silicon oxycarbide?

as small a variety of articles as possible, and the salesman selling this limited number in large quantities. The salesman's aim should not be to sell the highest value in pounds, shillings, and pence, but the largest number of articles his factory could economically turn out.

In the second group untrained workmen constituted the first cause for low production and discontent. One person should be responsible for engaging all staff and workpeople, for seeing that they were properly trained on arrival, and for the education and comfort of all the employés.

Excessive reduction in hours was to be guarded against, for while it had been proved that a gradual reduction often resulted in improved efficiency, a drastic reduction was a mistake, in that it did not give management or labour time to readjust themselves to new conditions.

Antagonistic labour was the third factor in the group. Labour must put aside the past mistakes of management, and management must take a wider and more humane view of the demands of labour. If management acted the nigger driver, labour would remain sullen and hostile, and might even try to absorb management into its ranks by force. But management could not be efficient if fettered either to capital or labour, its mentality and duties were quite different, and it must maintain a separate entity, nevertheless meeting labour in a friendly spirit in all disputes.

Strikes, declared the speaker, could only be avoided by honourable dealing on both sides. Management could nip disputes in the bud by arranging for the discussion of matters in which it and labour were jointly concerned. Labour's opposition to any form of payment by results was due to the past unfairness and laziness of management in handling the work.

It was now a commercial axiom that poor service was suicidal to industry. The true product of labour was skilled work. Labour, then, should encourage the useful and eliminate the wasteful, and should put itself in a position to demand the best price. Trade unions should have a research department to study the methods of payment, and they should at least share the responsibility of promoting a wages system which would bring about economy in production.

Concluding, the lecturer said he looked forward to the time when management's responsibility would be recognised by the public. Old prejudices must be overcome, capital, labour, and management must pull together for a better state. His chief fear was the hot-heads on each side, but surely there were enough level-headed, peace-loving men to bring about the changes in organisation that were necessary for the evolution of industry alongside of the security and well-being of labour.

That the lecture had provoked much keen thought was evidenced by the discussion which followed. A representative of each society spoke, and several members of the audience expressed their appreciation of Mr. Impey's address, one characterising it as the laying-down of first principles for the reorganisation of the industry of the country.

BUSINESS NOTES.

Bankruptcy Proceedings.—C. H. Steel, electrical engineer, 1, Nelson Square, Bradford.—Last day for proofs for dividend August 27th. Trustee, Mr. E. Owen, O.R., 117, St. Mary's Street, Cardiff.

J. W. Gladwin, electrical engineer, Meersbrook, Sheffield.—Last day for proofs for dividend August 27th. Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield.

C. T. Stanton (Southern Electrical Engineering Co.), 25, Beckenham Road, Penge.—First and final dividend of 7¼d. in the £ payable August 29th at the Official Receiver's offices, 133, York Road, S.E. 1.

Company Liquidations.—Portable Electric Motors (1919), Ltd.—In the summary of the statement of affairs the gross liabilities stand at £22,857, estimated by the officers of the company to rank at £11,114. The estimated total assets are £17,987, less £73 preferential creditors for rates, taxes, &c. The estimated amount available to meet the claim of debenture holders is £17,914. From this there are deducted loans on debenture bonds secured on the assets, £10,409. The estimated amount to meet unsecured creditors (subject to cost of liquidation) is £7,504, leaving an estimated deficiency of assets to meet the liabilities of the company, subject to the cost of liquidation, of £3,609. The statement as regards contributories shows a total deficiency of £30,962. It appears that the company was registered as a private company on April 3rd, 1919, with a nominal capital of £50,000 in £1 shares, its objects being to acquire and carry on the business of manufacturers of portable electric motors for cutting metals, stone, &c. The first directors were George Fryer and Lord Clifford of Chudleigh. The latter resigned in July, 1919. H. E. Sadd, F. Bright, and C. de F. Myburgh were appointed directors in July, 1919, and resigned in February, 1920. John Cooper and Stanley Lingard were appointed in February, 1920. No remuneration was fixed, and none appears to have been paid. Fryer was appointed managing director in April, 1919, with a salary of £12 per month, and ceased to act as such in February, 1920, from which date Cooper acted as managing director. No remuneration was fixed at the time of Cooper's appointment, but according to the minutes he and Fryer were to receive £500 per annum for their services as from October 1st, 1920, but nothing appears to have been paid to them on this account. Fryer states that he was the inventor of a portable electric motor for cutting metals, stones, &c., that he sold the patent to a company called "Portable Electric Motors, Ltd., for a consideration of £1,500 in fully-paid-up shares, the remaining capital of that company, £1,000, being issued to cash subscribers, and that, with a view to exploiting the patent, a new company was formed. On December 30th, 1918, an agreement was entered into between the shareholders of the old company and Miss Nona Small, for and on behalf of the new company then about to be formed, which provided that each shareholder of the old company should receive ten shares in the new company for each share in the old company; this agreement was adopted by the company on April 17th, 1919, and 25,000 shares were issued to the shareholders of the old company. By a further agreement dated April 17th, 1919, between the old company, its liquidator, and the new company, the latter acquired the goodwill and assets of the business of the old company, including the letters patent in connection with the invention connected with the portable electric motor previously referred to. The consideration was fixed at £1,000 payable out of profits only, but as no profits were made no part of the consideration had been paid. The company entered into contracts with one H. P. Girling for the supply of motors and drills, which continued down to October, 1920, when the directors decided that it would be better for the company to manufacture its own motors and drills. For this purpose the company acquired from Girling land, buildings, and machinery for a consideration of £4,500, payable as to £2,500 in cash and 2,000 fully-paid-up shares of the company. Additions were made to the buildings at a cost to the company of about £2,000. On June 16th, 1920, a debenture was issued to secure a loan of £5,000, and on October 21st, 1920, further debentures for £10,000 were issued for the purpose of paying off the above-mentioned debenture of £5,000 and to secure an overdraft and moneys to be advanced by the company's bankers. Cooper, who has financed the company to the extent of about £3,500, had control of the company's factory, and states that he aimed at manufacturing 500 motors and drills and ordered the necessary material for that number. The company, however, appears to have been hampered by want of capital, and on March 24th, 1921, the debenture holders appointed R. B. Petre, chartered accountant, of 11, Ironmonger Lane, E.C., receiver and manager on their behalf on the ground that execution had been levied upon the company's property. The receiver reports that he is not yet in a position to state whether the assets will realise sufficient to satisfy the debentures. The unsecured liabilities in the statement of affairs £8,981, include £3,509 and £925 advanced by Cooper and Lingard respectively, the balance being mainly in respect of goods supplied. The partly secured creditor for £3,393 for work done and goods supplied has a lien on assets valued at £1,260. The trading account lodged with the statement of affairs shows a gross loss of £17. Cooper states that this is accounted for by the fact that part of the stock has been valued at less than its actual cost to the company. The directors attribute the failure of the company mainly to the slump in trade and lack of sufficient capital. Fryer and Lingard also attribute the failure to the over-purchase of material, but Cooper does not agree with this. As a result of the meeting of creditors and contributories, held on July 19th, 1921, the Senior Official Receiver has become liquidator of the company.

Hudson's Electrical Engineering Co., Ltd.—Meeting of creditors called for August 29th at the Griffin Hotel, Boar Lane, Leeds. Mr. M. Emmerson, liquidator.

Sutton-in-Ashfield Motor & Electrical Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. Keetley, King John's Chambers, Bridlesmith Gate, Nottingham.

Oldham, Ashton & Hyde Electric Tramways, Ltd.—Winding up voluntarily. Liquidators, Mr. P. M. Rossdale and Mr. T. H. Underhill, 88, Kingsway, W.C. Meeting of creditors called for August 26th.

Dissolutions of Partnership.—Hartland & Ridgway, electrical and mechanical engineers, 286, Monument Road, Ladywood, Birmingham. Mr. H. Hartland and Mr. V. T. Ridgway have dissolved partnership.

Kilburn Magneto & Engineering Co., electric magneto and general engineers and dealers in electric lamps, 238, High Road, Brondesbury.—Messrs. F. Giladjian and E. J. Lord have dissolved partnership. Debts will be attended to by Mr. E. J. Lord.

Trade Announcements.—Messrs Perry, Savage & Co., electrical engineers and power specialists, have opened premises at 28, Conway Street, Birkenhead.

Messrs. Smith & Gill, electrical engineers and contractors, have opened new showrooms at 46, Cross Street, Nelson. We are informed that Mr. A. Smith is now the sole proprietor of the business.

Messrs. Ponsford & MacHardy, Ltd., are opening a branch at 165, High Street, Arbroath, on September 1st, and they wish to receive price lists and catalogues from manufacturers, factors, &c.

Catalogues and Lists.—Messrs. Marryat & Scott, Ltd., 28, Hatton Garden, E.C. 1.—A catalogue which, in addition to details and prices of many types of lifts and accessories, gives a great amount of information of value to those interested in lift engineering. The first part of the publication deals with various types of control apparatus such as switches, relays and control panels. The winding engine is treated of very fully, such details as gearing, lubrication, braking, &c., being described. The choice of position for the winding engine is discussed, and helpful suggestions are made. The last part before the catalogue proper describes various kinds of cars and explains the methods of calculating the total cost of an installation. A number of ordering codes is given. The book (which has 84 pages) is profusely illustrated, the coloured views of a number of cars and enclosures being especially excellent. The producers claim that a study of this volume will enable any engineer to design his own installation.

Messrs. John Phillips & Co., 166, Walworth Road, S.E. 17.—An illustrated leaflet giving details and prices of curved hack-saw blades.

Messrs. Landis & Gyr, Ltd., Windmill Road, Hampton Hill, Middlesex.—An illustrated leaflet dealing with patent induction-type indicating wattmeters.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Circulars Nos. 1,266/1 and 2, giving very complete details, with illustrations, of large oil circuit-breakers for extra-high pressures. Also a reprinted article from the "Metropolitan-Vickers Gazette" containing valuable information on the breaking capacities of oil switches and circuit breakers (Circular No. 1,254/1).

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, W.C. 2.—Five illustrated pamphlets dealing with the "A.B.C." "electric laundress" and ironer. One, "The A.B.C. of wash-day," points out advantages and gives some useful operating details.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C. 1.—Monthly Stock List No. 11, giving particulars of d.c. motors rated at from 1 to 50 h.p.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—"Disposal List," No. 880, giving prices and illustrations of electric heating and cooking appliances.

For Sale.—Ormskirk Board of Guardians invites offers for one 50-b.h.p. National gas engine coupled to a 220-V Witton multipolar dynamo.

By direction of the Disposal Board, Messrs. Fuller, Horsey, Son & Cassell will sell by auction on September 6th, at Purfleet, plant and machinery, including generating sets, electric winches, &c. Messrs. H. & R. L. Cobb will sell by auction on August 29th and following days at H.M. Explosive Factory, Lower Hopepoint, Cliff-at-Hoo, Rochester, machinery, plant, general stores, &c., including generating sets, electric motors, wire and cable, fittings, &c.

Messrs. Thomas Whitfield & Son will sell by auction on September 6th and following days at the Shawbury Aerodrome, near Shrewsbury, the whole of the electric light and power plant, 165 buildings, fittings, stores, &c. For full particulars see our advertisement pages to-day.

Wages Reductions at Dowlais.—Fitters and turners at the Dowlais works, Cardiff, have accepted a reduction of 30s. on their former wages of £6 a week, and agreed to a further cut of 5s. later on.—*Times.*

Produce for Germany on Nine Months' Credit.—Interesting details have reached us regarding the long-credit transactions which were arranged for the export of wool and hides from Uruguay to Germany. Nine months was the term accorded. Bills at 270 days were drawn on the Deutsche Bank at Berlin to the order of the German Bank of Montevideo, the currency being Uruguayan gold pesos. The drafts were accompanied by B/L's, invoices, insurance policies, and all other documents relative to the shipments of wool and leather. The German Bank of Montevideo discounted the drafts at the Bank of the Republic at the rate of 6 per cent. per annum, the latter sending them to its Berlin correspondent for acceptance. Directly the bills were accepted the shipping documents were forwarded to the Deutsche Bank.

Coal v. Oil.—Tests carried out at the Crown Point power station of the Leeds City Council indicate that oil fuel can only compete with coal if it costs 57s. per ton with coal at 36s. per ton, or 57s. with coal at 37s. 6d.

E.D.A. Activities.—The British Electrical Development Association has pressed into the service of electricity that popular modern vehicle of fiction, the short story. "The Awakening of Peterkin" (E.D.A., 182) tells of a salesman who was galvanised into activity and "brought off" a big "deal" by the enthusiasm of his wife for electrical methods. *Cherchez la femme!*

Copper and Lead Prices.—Messrs. F. Smith & Co. report August 16th: Copper (electrolytic) bars, £76, 10s. increase. Ditto, electrolytic sheets, £145 10s., 10s. increase. Ditto, electric wire rods, £92, 10s. increase. Ditto, H.C. wire, 11 9/16d., 1/16d. increase. Messrs. James & Shakespeare report August 16th: Copper bars (best selected) sheet and rods, £103, £2 decrease. English pig lead, £24 15s., 5s. decrease on last week's figures.

Electrical Wages reduced in America.—A wage reduction affecting 12,000 employés of the General Electric Co.'s plant is announced. The cut will vary according to the several classes of employés, unskilled workers' wages showing the greatest reduction. The announcement followed conferences between the management and a committee of employés at which means to assure continued operation of various departments were discussed.—*Reuter's Trade Service*, Lynn, Mass., August 4th.

Book Notices.—We have received from Messrs. Mavor and Coulson, Ltd., the first issue of a magazine which is to appear monthly. This bears the title "M. & C. Machine Mining," and is devoted exclusively to the application of machinery to the economic winning of coal; it claims to be the first of its kind. In this first number "Universal" coal cutters are dealt with fully, and notes connected in various ways with machinery in mining are included.

"The Journal of Industrial Welfare," Vol. III, No. 8, August, 1921. Price 9d.—Among a number of interesting articles included in this issue is one upon the artificial lighting of workshops and factories.

"Income Tax Up-to-Date." By H. J. Gully. Published by the *Financial News*. Price 9d.

The Times issued a special railway number on Monday last to celebrate the end of Government control of the systems of the United Kingdom. There are numerous interesting articles, including one on railway electrification, one on equipment arrears that have to be met, and another on signalling.

"Metropolitan-Vickers Gazette," Vol. VI, No. 100, July, 1921. Price 1s., post free.—Premier place is given in this issue to a description of the visit of the Prince of Wales to the Trafford Park works. The technical articles include: "High Efficiency Steam Turbines"; "A.c. Electrical Equipment of Mine Haulages," by Charles E. Raeburn; and "Breaking Capacity of Oil Switches and Circuit Breakers," by W. A. Coates, M.I.E.E.

"Liquid and Gaseous Fuels." By V. B. Lewis (pp. xiv+354; 59 figs.). London: Constable & Co., Ltd. Price 12s. 6d. net.

British Engineering Standards Association.—The latest specification (No. 101—1921, 1s. net) issued by the Association lays down standards for tramway tires.

The profile of tread and flange originally standardised and issued in the British Standard Specification for Tramway Rails in 1903 has been retained, but in place of the varying widths of tire then provided to suit the British Standard Sections Nos. 1 to 5, one uniform width has been adopted suitable for rails having a tread of 2¼ in., which dimension, we understand, is being recommended for the revised rail sections now under consideration and approaching issue. This width is that of the B.S. Section No. 4, probably the most extensively used of the standard sections. Three diameters of tire are provided for, namely, 32 and 33 in. (with thicknesses of 2¼ and 3 in. respectively) for tramway driving wheels, and 22 in. (with a thickness of 2¼ in.) for pony wheels, and the plate attached to the specification gives the finished sizes of these and the rolling allowances for machining.

Electricity in the Textile Industry.—Mr. Arthur Charles, managing director of Components, Ltd., of Burnley, told a Burnley gathering last week that electrical plant, correctly installed, was safer than any other agent, and it was as economical. He pointed out that in 1910, 998 consumers in Burnley paid for 3,249,287 units, as compared with 3,000 consumers and 7,591,107 units last year. Coun. L. Thornber, a prominent cotton manufacturer, said the application of electricity to textiles was all a question of cost. So far as he could gather, electricity for mill power could not be supplied cheaper than steam could be produced. Electricity would have to be produced under at ¼d. per unit to be profitable in the running of cotton mills, though he was prepared to admit that electricity would ensure a better and steadier drive.

Mr. J. Holden, chairman of the Electricity Committee, stated that electricity was produced in Burnley more cheaply than in most places in the country. In fact, there were only eight towns in England where it was produced at lower cost.

New Italian Company.—La Società d'Eletricittà de la Venezia is the name of a new company which has recently been organised in Padua with a capital of 10,000,000 lire.

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries:—

The Limpet Magnetic Hand Lamp (lettering and design), No. 414,667, Class 13. Magnetic hand lamps. William Barton & Sons, 11, Forrest Road, Edinburgh. April 27th, 1921.

Instarter, No. 414,631, Class 8. Electrical resistances adapted for use with induction and air supply pipes of internal-combustion engines. E.D. Motors, Ltd., Empire House, 175-6, Piccadilly, London, W. April 26th, 1921.

Superforma, No. 415,539, Class 50. A preparation of oils for electrical insulating purposes. C. C. Wakefield & Co., Ltd., 30-2, Cheapside, London, E.C. May 26th, 1921.

Rickite, No. 415,435, Class 40. Covering, insulating, and like material manufactured from india-rubber. Edwin Rickard, 7, Parkinson's Chambers, Hustlergate, Bradford. May 24th, 1921.

Lead.—Messrs. James Forster & Co., reporting under date August 13th, state:—"The intrinsic position is unchanged. Consumers have bought sparingly and export is quiet, although France is still a buyer this week. Arrivals are short, and to fulfil July contracts a heavy call has been made on lead in store. . . . The whole of the Government stock of lead has been disposed of privately. The Board of Trade returns for July are:—

Imports	12,718	tons
Exports	2,042	,,
	10,676	,,
Taken out of stores	882	,,
Total left for home consumption ...	11,558	,,

Of the above, 8,011 tons came from Spain."

Swiss Exports of Energy.—The anger of the Swiss Federation of Consumers of Electrical Energy, which is said to be composed of the largest customers of the supply works in Switzerland, has been aroused by the fact that the Federal Council has authorised the export of 6,000 kW at an exceedingly low price to the Lonza Electro-Chemical Works at Waldsput, Germany. It is pointed out that a veto is imposed on the import of Swiss carbide into Germany, and the Federation has asked the Federal Council to withdraw the authorisation in question until Germany removes the obstacles in the way of the importation of Swiss products into that country.

Calcutta Distribution Pillars.—The accompanying illustration shows one of a large number of distribution pillars

Calcutta Distribution Pillar Fitted with Henley Units.

erected in Calcutta by the Calcutta E.S. Corporation, Ltd. They are fitted with Henley patent pillar units, and one of Henley's durwans, who has apparently taken paternal interest in the erection of the pillar, is shown in the picture.

Parcels by Air.—The Postmaster-General announces a reduction in the rates for the carriage of parcels by aeroplane to Paris. The new charges range from 1s. 6d. for packets weighing up to 1 lb., to 9s. 9d. for parcels of 11 lb. weight.

Swiss Electro-Chemical Production.—During the war the output of German electric furnaces was strongly developed, especially by power stations, electro-chemical works, and the various groups interested in lignite mines. So long as coal was cheap those industries could easily compete with Swiss products, not only in Germany, but also in other Continental countries. A serious crisis consequently overtook Swiss producers, and most of their factories were closed during 1920. Fortunately, however, the high price of imported coal resulted in such an increased production of hydro-electric power all over Switzerland that the electro-chemical works soon began to recover. To this export statistics for January to May bear witness. The export of aluminium, which during the first five months of 1920 averaged only 406 tons, rose to 633 tons. This figure is even higher than the average of 1913. The Swiss export of calcium carbide amounted in 1913 to a monthly average of 2,500 tons, during the first five months of last year to only 283 tons, but in January to May of 1921 to 665 tons.—*The Times Trade Supplement.*

Insulated Conductors in Finland.—A petition has been presented to the Finnish Council of State on behalf of the engineering firms of Zitting & Co. and the Finnish Cable Works Co., asking for an increase to be made in the import duties on insulated electrical conductors, as the Finnish makers in this branch are unable successfully to compete with German works. It is stated that the duties on these conductors are 7½ times greater in Germany than those applied for the protection of the Finnish works.

Foreign Trade.—July Figures.—The following were the values of imports and exports of electrical goods and machinery during July, 1921:—

	July, 1921.	*Inc. or dec.*	7 months, 1921. *Inc. or dec.*
Imports.	£	£	£
Electrical goods, &c.	114,752	− 27,506	+ 616,796
Machinery	853,707	− 835,613	− 3,053,190
Electrical machinery (included above)	55,921	− 39,319	− 94,191
Exports.			
Electrical goods, &c.	1,157,591	+ 192,755	+ 2,617,920
Machinery	6,130,712	−1,213,345	+16,084,117
Electrical machinery (included above)	407,954	+ 205,992	+ 1,714,806
Re-exports.			
Electrical goods, &c.	12,775	+ 1,688	+ 81 009
Machinery	112,315	− 42,814	− 200,163
Electrical machinery (included above)	4,267	+ 2,318	+ 7,345

Austrian Electrical Industry.—The *Economic Review*, quoting the *Neue Freie Presse* for July 17th, says that the latest reports regarding the state of the German electrical industry are somewhat pessimistic, but this is no doubt due to the disturbing political conditions of some important areas. The Austrian industry cannot complain of any lack of business. From all the big firms come cheerful reports, recording an amelioration of all facilities for work and an improved quality in the work done. The State projects for the electrification of the railways are in full progress, and orders for the construction of water-works under the partial control of local government authorities become increasingly frequent, while there is no lack of private orders for agricultural, manufacturing and household purposes. As soon as the projected building schemes are put into operation there will be a large increase in orders for all kinds of household installations. Without exception, all the principal firms have recently greatly increased their capital, *e.g.*, the Siemens-Schuckert Werke have increased their joint-stock capital by Kr. 75 mill., making a total of 200 mill., and the A.E.G. Union Electrical Co. by Kr. 100 mill., making a total of 225 mill. This is not due only to increased price of materials or falling off of the exchange, but chiefly to the decision of German parent firms to enter into closer relations with Austrian establishments. The tendency to close Austro-German collaboration has been greatly enhanced by the application of the "Sanctions" against Germany. The introduction of the Bill for the favourable treatment of hydro-electric enterprises, giving special exemptions to the electrical industry from certain taxes, has created a very favourable atmosphere.

Japanese Export Trade.—Japanese exporters have been agitating for Government assistance to their trade. It seems from the *Board of Trade Journal* that at a combined meeting of Tokio and Yokohama exporters, which was attended by the Director of the Commercial Bureau of the Department of Agriculture and Commerce, and many other prominent persons, the following resolutions were passed:—

1. That the Railway Bureau give special reduced rates and special facilities to goods destined for export.
2. That the Government take steps to lower prices.
3. That the Government grant special exchange rates in the cases of export transactions.
4. That the Government provide some sort of an institution for the benefit of both producers and exporters.

The Production of Aluminium.—The world's production of aluminium has increased nearly three-fold during the past eight years. The following figures are given in a French contemporary:—

Country.	Production in 1913. Tons.	1920. Tons.
Germany	1,000	40,000
Austria and Switzerland ...	11,000	25,000
France	18,000	20,000
Great Britain	7,500	12,000
Italy	1,000	7,000
Norway	1,500	16,000
United States	28,000	73,000
Total	68,000	193,000

Contractors' Registration in Australia.—The Electrical Contractors' Association has asked the Minister for Labour and Industry to secure registration of contractors, principally, it is stated, to prevent the risks of fire and shock caused by faulty installations. A deputation said that anybody could call himself an electrical contractor at present whether he knew anything about the business or not.

Electric Furnaces in Belgium.—The Cockerill Works at Seraing is reported to be making progress in reconstruction after the damage caused by the war, and has now started working its electric steel furnaces for the making of motor-car and other machine parts, delicate and complicated pieces of unusual thinness calling for a quality of steel only turned out by the electric furnace. The Ougrée Marihaye Co., which added in 1914 to its other manufactures that of "special steel," has also set up two electric furnaces, a rolling mill, and a machine hammer, which enables it to produce twelve qualities of carbon steel, four of nickel steel, and three of silicon steel, the last-named being for use in the making of sheet steel for dynamos and transformers.

The German Electrical Industry in July.—The improvement in business in the German electrical industry is reported to have continued in July. According to information received by the Prussian Ministry for Commerce, the orders for installation materials increased in consequence of the revival in building activity, and the demand also improved for small and medium-sized motors for agricultural purposes. Orders from industrial circles remained on the favourable level of the previous month. A number of orders for telephone apparatus was placed by the Government, and the cable branch also improved slightly. Raw material prices increased to some extent, but those of manufactures showed a falling tendency. Despite the general improvement, it is impossible to utilise the full capacity of the works in certain branches, particularly in the production of measuring apparatus in the district of Frankfort-on-Main. Concerning the foreign trade, it is stated that the export of electrical manufactures left something to be desired, being hampered, as reported for the district of Berlin, by the large increases in Customs duties in other countries.

Belgian Electrical Construction Co.—The directors of the Constructions Electriques de Belgique, reporting on the year ended April 30th, 1921, stated that the report was the first submitted since the absorption of the Anciens Ateliers Van den Kerkhove, of Ghent, and the year was necessarily a period of starting the new organisation of the works. The results obtained were satisfactory, and would have been even more so had it not been for the crisis affecting all industries. The orders booked had permitted of the works at Liége and Ghent being sufficiently supplied with work, and the general course of the industry led to the hope that the company would traverse the period of scarcity of business without great difficulty. However that might be, advantage had been taken of the period of quietness to push on the development of the works and the construction of a new foundry. The understandings which had been reached with French and English groups, particularly with the Société des Constructions Electriques de France and the English Electric Co., not only assured the company the working of patents and processes held by these groups and their technical co-operation, but also permitted of the hope of obtaining good customers for the production. During the year the company acquired most of the assets of the Société Auxiliaire de Constructions Electriques. The gross profits earned in 1920-21 amounted to 4,625,000 fr., permitting of the extinction of the remainder (1,372,000 fr.) of the deficit arising from the years of war. The final result was a net profit of 1,918,000 fr. and a dividend at the rate of 6 per cent. on a share capital of 40,000,000 fr. As a consequence of the interests assumed in the company by the English Electric Co., it is proposed to elect a representative of the latter on the board of the former.

Unemployment.—The latest Ministry of Labour unemployment statistics show that the total number of persons out of work on August 5th was 1,738,000, a reduction of about 42,000 on the previous week's total. There were also 63,400 fewer on "short time."

Withdrawal from District Council.—Sunderland Town Council has decided, on the advice of its Electricity Committee, to withdraw from the District Council (No. 1) North-East Coast Area (Electricity Supply Industry), but it has agreed that the terms and conditions of employment laid down by the District Council shall be adhered to except (*a*) as regards mechanical and electrical fitters, blacksmiths, and building trades employés, who will continue to be employed on terms and conditions for the time being agreed between the recognised local employers' and employés' organisations, and (*b*) that the terms of Award No. 579 of the Industrial Court with reference to holidays for skilled men and their assistants shall be strictly observed.

Duties on Electrical Imports into Spain.—The Association of Producers of Electric Power has protested against some of the duties in the new draft tariff on material used in the electrical industry. The Association points out that certain articles, as, for example, tubes for pressures of over 25 atmospheres, cannot be obtained in Spain. One of the members of the Association has ordered 1,000 tons of these tubes in Germany at about 1,000 pesetas per ton; if the customs duties proposed in the draft tariff are brought into effect without reduction these goods will have to pay 1,600 or 800 pesetas a ton, according to whether they are admitted under the first or second column of the tariff. Purchasers of large parts and very high-pressure apparatus will be similarly affected, the Spanish market for these goods being too small to warrant the setting up of works for their manufacture in the country.—*Reuters' Trade Service* (Madrid).

Wages Reductions.—The general manager of the Sheffield Corporation Electricity Department reports that the wage reductions recently agreed upon will reduce the department's expenses by £12,000 per annum. Reductions in the salaries of the technical staff will effect the saving of an additional £1,344.

Germany and Australia.—The *Sydney Morning Herald* quotes, as a typical example, a letter received by an Australian firm from a Charlottenburg manufacturer of electric lighting fittings. If the business proposed were done under the present conditions of exchange and tariffs, effective competition by any Australian, British, or American manufacturer would be out of the question. The letter says: "I am prepared to concede to you a rebate of 10 per cent. for orders of not less than £100 value. I would particularly draw your attention to the fact that the goods quoted for are of high-class quality and finish, equal to British make, and must not be confused with cheap Continental manufactures. The prices quoted include packing and delivery f.o.b. Rotterdam or Hamburg."

Electrical Trade in China.—The *Chamber of Commerce Journal*, in the course of an article on Chinese markets for general hardware, quotes a Canadian review of the situation. It is reported that the general extension of electrical development has created a large demand for electrical equipment of every description, and in China the trade is very active; electrical fittings of all kinds are required, also wiring, cables, switches, plugs, insulators, door bells, &c. A large demand also exists for fans, both desk and ceiling, as such are universally in use during several months of the year. With the further extension of electrical installations throughout the cities of China this trade will probably greatly increase in the future. "Large quantities of pipes and tubes and pipe fittings are annually required in China. These include wrought iron and galvanised steam and water pipes and boiler tubes. Cast iron pipes for waterworks and gas companies are also imported in considerable quantities. The greater portion of the above formerly came from England, but since the war the United States and Japan have been furnishing the bulk. The present-day condition of the hardware trade is no index of what the future will have to offer. Industrial enterprises in China must soon be put under way. Railways must be built, and agricultural methods vastly improved if China is to make any headway at all, and the hardware trade must also expand through the needs of these enterprises."

Belgian Activity.—In addition to the order for 36 locomotives which Belgian engineering works recently received from China, they have just received a further order for 425 trucks. A Liége firm has obtained an order for 20 locomotives for Spain.—*The Times.*

New French Companies.—La Compagnie Radio-France (Installations Radio-Electriqués) is the name of a new company which has recently been formed in Paris (79, Boulevard Haussmann) with a capital of 60,000,000 fr.

Among the new companies recently formed in France in connection with the utilisation of pater power for generating electricity are the Société des Forces Motrices de la Vallée d'Aspe, Paris (16, Rue de la Pepinière), capital 10,000,000 fr.; and the Société Hydro-Electrique de la Basse Romanche, Paris (27, Rue de Turenne), capital 1,000,000 fr.; the last-named concern will devote its attention to developing the water resources of the Department of Isère.

The Germans in Jugo-Slavia.—The Siemens-Schuckert group is reported to have formed, with the co-operation of the Croatian Discount Bank, a company at Agram for the import of semi-finished electrical materials on a large scale for conversion into manufactures in a works at Agram.

LIGHTING AND POWER NOTES.

Aldershot.—Belgian Tender Refused.—It is reported that the Council recently rejected a Belgian tender for electrical plant, although the price quoted was £600 less than that given in the lowest British tender.

Australia.—Brisbane (Q.).—The City Electric Light & Power Co. has recently installed new plant at a cost of £600,000, and now controls practically the whole of the Brisbane supply. The suburban districts of Hamilton, Stephens, Balmoral, Coorparoo, and Sherwood are already receiving supplies, while extensions are being made to Toowong, Windsor, Toombul, and Sandgate.

Ayr.—Consultant's Report.—At a meeting of the Town Council, on August 8th, consideration was given to a minute of the Lighting Committee, which stated that a report had been received from Mr. Rider, consulting engineer, with regard to a proposed scheme of electricity supply for the Burgh of Ayr at Loch Doon. Mr. Rider was of opinion that the Loch Doon scheme was of such a promising character and involved such a small amount of engineering work that it should be put in hand at the earliest possible moment. In the course of discussion one member stated that the proposed scheme would entail an expenditure of approximately £250,000. The Council resolved to proceed with the scheme.—*Scotsman.*

Bangor.—New Plant.—As a bulk supply will not be available for some time, and to meet the demands of consumers for the next two years, a 100-kW Diesel engine generating set is to be installed at a cost of £4,630.

Beckington (Somerset).—Proposed Lighting Scheme.—A public meeting was recently held to discuss the question of a scheme of electric lighting for the locality. A representative of Edmundsons' Electricity Corporation attended and stated that it was proposed to utilise an old mill on the river for the generation of electricity, and the price per unit would be about 10d.

Carlisle.—Year's Working.—The report of the city electrical engineer (Mr. C. W. Salt) for the year ended March 31st, 1921, states that the undertaking had a revenue of £54,617, as compared with £48,971 in 1919-20. Working costs amounted to £41,491, as against £34,655, leaving a gross profit of £13,126 (£14,316). After payment of capital charges, &c., a net profit of £455 remained; the net profit in the preceding year was £2,301. The number of units sold was practically the same as in the previous year, the greater revenue being derived from increased prices.

Clacton-on-Sea.—Loan.—The Urban Council is applying for sanction to borrow £2,000 for electricity purposes.

Continental.—France.—A *Reuter* (Paris) message states that a group of American engineers and financiers has undertaken to experiment with the tidal power in the Bay of St. Michel where the rise and fall is considerable. The experiments are estimated to cost 2,000,000 fr. A barrier will be erected from the Point du Roc to Le Ligouet, a distance of 12¼ miles. There will be special outlets through the barrier for rivers emptying into the bay and for shipping. By this means it is hoped to secure an annual output of 6,000,000,000 kWh.

The French Commission proposes to erect a barrage at Aber-Wrach. This will be 150 m. across the estuary and 13 m. above the spring tide level. The barrier will be constructed of hollow reinforced-concrete blocks; the centre block, which will be 35 m. long and 22 m. broad, will contain turbo-alternators. Arrangements will be made to utilise both rising and falling tides, a difference in level of 2¼ ft. being sufficient to keep the turbines running. Four turbines and two alternators will be used capable of producing from 75 to 1,200 h.p. each. To equalise the power, a storage dam of 12,000,000 cu.m. is to be constructed in such a manner that a fall of 8 m. will be obtained at high tide and 20 m. at low tide. The regular output is estimated at 1,600 h.p. with a maximum of 4,800 h.p. According to M. Moreau, Dean of the Faculty of Sciences at Rennes, the French coast from Boulogne to Brest could yield some 6,000,000 h.p. by the utilisation of the tides for power generation. The Breton shore alone could furnish 1,000,000 h.p., a huge figure when it is recalled that Paris consumes only 250,000 h.p. This immense source of energy should not, he contends, remain neglected, for in Brittany alone there are extensive beds of iron of a quality equal to that of the Briey product, if not better. Brittany would be able to supply the raw materials to the French iron-working industry for several centuries.

A *Central News* message reported, last week, that while a party of men were laying a cable at Argeles they received a severe electric shock, four being killed instantly and eleven badly burned.

Italy.—The Sila hydro-electric scheme whereby between 150,000 and 300,000 h.p. would be obtained, yielding 800,000,000 kWh yearly, successfully started, has had to be suspended owing to the present financial crisis in Italy. With it are hung up the scheme for a local electro-chemical industry and the projected transmission of energy in the province of Puglia and across the straits of Messina into Sicily. The delay will probably serve to benefit the last-named project, by allowing of a more complete study of the obstacles to be met with on its realisation. According to the Italian engineer, Vismara, the distance to be covered to Messina, 180 kilometres, will be traversed by submarine cables. The currents are very strong in the narrowest part of the channel, the bed is rocky, and the cables would be liable to serious deterioration from the stony fragments churned up by the currents. The best parts of the coastline, where the currents are less strong, are already occupied by telephone and telegraph cables, the only alternatives being points to the north or south of this belt, where the bed is sandy and the currents weaker. Earthquake shocks have also to be taken into account.

The projected scheme of the Banca Conti e Ca., of Florence, for generating electricity by means of the lignite beds at Nestore, in the province of Perugia, has secured special Government subsidies towards its fullest realisation. The company undertakes to install a plant of a capacity of 12,000 kW, with a normal output of 8,000 kW, also providing for recovery of the by-products of sulphate ammonia and tar. The Government's subsidy is fixed at 150 lire per kW installed, for a period of 20 years.

Esthonia.—Negotiations are reported to be proceeding between the Government of Esthonia and the Reval branch of the Siemens-Schuckert Works with regard to the establishment of hydro-electric works on the Narva for the utilisation of 50,000 h.p. The scheme is a revival of a plan projected by the late Imperial Government of Russia.

Spain.—Data collected in 1920 gave the amount of developed water power as 618,756 h.p., of which 577,192 h.p. was produced by the larger installations, nine of which were of over 10,000-h.p. capacity. There were also under construction hydraulic works totalling over 300,000 h.p., the largest of which were those of the following:—Sociedad Hidraulicas Iberica (60,000); Soc. Riegos y Fuerzas del Ebro (50,000); Soc. Hidroelectrica Española (40,000); Soc. Electra del Viesgo (22,000); Soc. Saltos del Cantabrico (15,000); Soc. Hidro-electrica de Castilla (15,000); Soc. Mengemor (7,000); Soc. Saltos de Somiedo (6,000); Soc. Sevillana de Electricidad (5,000); Soc. Electrica de los Almudeses (9,000); Soc. Productora de Fuerzas Motrices (15,000); and Soc. Wenceslao Garra (18,000). As the output of coal will tend to decrease by the exhaustion of the beds, the day is not far distant when the water power will wholly replace coal in the generating of electricity.

Dorchester.—Electricity Supply Order.—The *London Gazette* gives notice that the Borough Council has applied for a Special Order permitting it to generate and supply electricity within the borough.

Dublin.—Public Lighting.—Contrary to expectation, the full public electric lighting service was not given by the Corporation for Horse Show week, but on one or two nights an extended service was given in some central areas. The economy regulation provides for the extinction of all public lamps at 12.15 a.m.

Federated Malay States.—Proposed Public Supply.—At a meeting of the Council of the Federated Malay States, held at Kuala Lumpur during April, writes the United States Consul at Penang, it was decided to engage an electrical staff to investigate the question of a public power supply. The sum of $150,000 (Straits currency) was voted to defray the salaries and expenses of this staff, which included ten engineers, surveyors, and draughtsmen. A preliminary survey had already been made by the Government Electrical Adviser, which called for an expenditure of approximately $40,000,000. The development of a comprehensive electric power scheme would be of tremendous value to the industrial facilities of the Federated Malay States, and the application of low-cost power to the mining of tin should greatly stimulate that industry.—*Commerce Reports.*

Glasgow.—Annual Report.—The report of the engineer of the electricity undertaking (Mr. R. B. Mitchell) for the year ended May 31st last contains a great deal of interesting information. The total number of units sold was 151,688,636, the proportion of lighting energy to power supplies being as one to five. This total is an increase of 3,193,546 upon the previous year's sales. During the year 3¾ miles of low-pressure feeders were laid and 18¾ miles of high-pressure feeders, as well as 14¼ miles of distributors. The generating plant at the Govan station, which is now to be used as a sub-station, is being disposed of to make room for converting plant. There are five sub-stations in course of construction. During the year under review the first two 18,750-kW turbo-alternator sets were installed at Dalmarnock and two more sets will be in commission for the coming winter. In future the Port Dundas station is only to run ten hours a day, and no further plant will be installed in this station. The maximum load on the system rose during the year from 66,200 to 76,964 kW.

Hastings.—Year's Working.—The accounts of the Corporation's electricity undertaking for the year ended March 31st last, show a total revenue of £42,309, as compared with £32,604 in the preceding year. Working expenses amounted to £34,277, as against £21,444, leaving a trading balance of £8,032 (£10,620). After the payment of capital charges, &c., the net result was a deficit of £247; the result in 1919-20 was a profit of £3,552. The total number of units sold increased from 1,214,050 to 1,521,660.

Japan.—New Hydro-electric Plant.—A plan for the construction of nine hydro-electric plants to use the waters of the Sho and the Chigusa Rivers, is being considered by the Hyogo Prefectural Assembly. It is proposed to begin construction in 1921 and to complete three plants every two years until 1926.—*Commerce Reports.*

Liverpool.—Amalgamation of Undertakings.—At a conference between the representatives of the Liverpool and Bootle Corporations, it was agreed that the town clerk of Liverpool should forward to the town clerk of Bootle the draft heads of a proposed agreement for the amalgamation of the two electricity undertakings. This the Bootle Electricity Committee has received, and after considering it, reports that it is prepared to agree to the amalgamation of the undertakings subject to satisfactory terms being arranged.

Llandovery.—Electric Lighting not Desired.—At a meeting of the Town Council on August 9th, it was moved that a public meeting be called to consider the adoption of electric lighting in the town. An amendment to take no action in the matter was, however, carried.

London.—Stepney.—The annual report of the engineer and manager (Mr. W. C. P. Tapper), and the statement of accounts of the electricity undertaking for the year ended March 31st

last, have come to hand. The total income was £229,321, as compared with £205,156 in the previous period. Working expenses amounted to £175,972, as against £159,421, leaving a gross profit of £53,349 (£65,735). After paying capital charges and taking in sundry credits, the net result was a profit of £9,376, a considerable reduction on last year's profit of £23,376. The total number of units sold, 25,033,611, represented a decrease of 229,464, accounted for by the trade depression. The net profit was transferred to the appropriation account, but the heavy charges against this, including income tax, £7,161, necessitated the transfer of £8,417 from the reserve fund.

Monaghan.—Electric Lighting.—The Urban Council is in communication with the Lighting Co. regarding the lighting of the town by electricity during the coming winter.

New Zealand.—Lake Coleridge.—The past year's working of the Lake Coleridge hydro-electric undertaking was again satisfactory. This scheme, which supplies Christchurch, had a total revenue of £51,373, an increase upon the previous year's revenue of £5,540. Working expenses increased by £3,582 to £21,341, the gross profit thus being £30,032, as against £28,074. Most of this was absorbed by interest and depreciation charges, but there was a net profit of £3,447. The actual result for the whole of the period during which the plant has been running has been a loss of £30,647. The output increased by about 10 per cent. to 36,309,580 units. The plant, whose rated capacity is 8,000 h.p., has been sustaining a daily overload of 20 per cent.

Electrical Development.—During the past twelve months 20 miles have been reticulated and 2,000 new customers added in connection with the extension of the Auckland City Council's electricity scheme. The profit for the year ending March 31st aggregated £17,000. The city engineer forecasts the following requirements during the next two years: Meters, £10,000; 60 miles of reticulation, £30,000; and sub-station and feeder extensions and switchgear, £25,000. The Council has accepted contracts totalling £278,000, which will be provided for from the recent loan of £500,000.—*Reuter's Trade Service* (Melbourne).

Oswestry. — Proposed Purchase of Undertaking. — The General Purposes Committee has recommended that, provided satisfactory terms could be arranged, it would be to the interests of the borough that the Council should acquire the undertaking of the Electric Light & Power Co. The company is to be approached with a view to ascertaining the purchase price of the undertaking.

Portishead.—Prices.—On August 9th, Col. T. E. Ekin held an inquiry into the application of the North Somerset Electric Supply Co. for permission to increase its maximum charge to 1s. per unit. It was explained that it was not intended to charge more than 9d. per unit at present, but the company wished to be prepared for any eventualities. It at present had a contract for large supplies to the Portbury shipyard and a local company. The first contract was determinable by six months' notice, and the other customer might cease to take electricity at any time. These two consumers took three-quarters of the output. Expenses were heavy, as the company had a wide, thinly-populated area of supply. A number of local bodies opposed the application.

Portsmouth.—Year's Working.—The accounts of the electricity undertaking (Mr. B. Handley, engineer) for the year ended March 31st last show a total revenue of £114,384, as compared with £91,685 in 1919-20. Working expenses were £91,405, as against £68,623, leaving a gross profit of £22,979 (£23,062). The payment of capital charges left a net profit of £2,072, which was considerably less than the previous year's net profit of £5,754. The running deficit on the undertaking has now been reduced to £1,303. The number of units sold was 4,885,782, and the maximum demand during the year was 3,410 kW.

Sale (Cheshire).—Bulk Supply.—Subject to the approval of the Electricity Commissioners, the Council has agreed to take a supply of electricity in bulk from the Manchester Corporation.

Sheffield.—Opening of new Station.—The Duke of York has promised the Lord Mayor of Sheffield that on the occasion of his visit to the city in October, for the Cutlers' Feast, he will stay to open the new power station of the Corporation at Blackburn Meadows.—*Sheffield Independent.*

Electricity Failure.—On the night of August 11th several districts were affected for half an hour by the failure of the electricity supply. It was discovered that water had got into a faulty main.

Stretford.—Rotary from Salford.—The Electricity Committee has confirmed the purchase of a 500-kW rotary converter set from the Salford Corporation to be delivered and handed over in complete running condition for the inclusive sum of £2,170, or any lower figure which the chairman may be able to negotiate.

Strichen (Aberdeenshire).—Lighting Scheme.—It has been decided to light the village electrically. A company is to be formed with a share capital of £3,500.

Taunton.—Deficit.—The deficiency of £1,073 on the year's working of the electricity department is mainly due to the increase in the price of coal; wages have increased from £25 per week in 1914 to £100 per week this year. During the 27½ years' municipal ownership of the undertaking it has cost the rates only £500, and of £100,000 loan capital, £60,000 has been redeemed. The Town Council has authorised the Electricity Committee to increase, if necessary, the charge for electricity from 110 per cent. to 120 per cent. above the pre-war scale, the price not to exceed 1s. per unit.

Warrington.—Water-power Report.—It will be remembered that in a recent issue mention was made of the fact that the electrical engineer (Mr. F. V. L. Mathias) had been instructed to prepare a report upon the possibility of utilising the water power of Woolston Weir for the generation of electricity. The report states that the maximum fall at Woolston Weir is approximately 8 ft. with small quantities of water passing over the weir. Definite figures at this stage could not be put forward as to the relation between the levels and the flows, but it was quite certain, stated Mr. Mathias, that the power derivable from Woolston Weir would be very small compared with the power required in Warrington, either at the present or in the future. The maximum load in Warrington was over 5,000 kW, with the certainty of a considerable increase in the near future; possibly an average of 150 kW with a load factor of 50 per cent. would be the figure for Woolston Weir. This would represent about 660,000 kWh per annum, and the capital cost, provided no exceptional difficulties were encountered, would be about £25,000. The total expenses would be about £4,000 per annum, representing 1.46d. per kWh generated. This figure was comparable with steam costs at the present prices of coal. Mr. Mathias pointed out that if the Corporation embarked upon the scheme it would assume responsibilities with doubtful financial benefit. The records of low-fall water-power plant in this country at pre-war constructional costs compared with pre-war coal prices were not encouraging. New works would have to be constructed at post-war figures, with the probability of a fall in coal prices. It is thought that the present moment is hardly opportune for the further consideration of the project, and it should be deferred until conditions become more established.

Year's Working.—A remarkable improvement is evident in the report upon the electricity undertaking for the year ended March 31st, 1921. The revenue rose from £90,188 to £123,365, and expenditure from £80,613 to £92,212. The gross profit thus increased from £9,575 to £31,153. Capital charges were heavier than those of the preceding year, but the net result was a profit of £12,037, as compared with a deficit of £1,850.

Whitehaven.—Loan.—The Town Council has applied for sanction to a loan of £1,300 for the laying of a main in connection with the extension of supply to Kells.

Willesden.—Year's Working.—The report upon the electricity undertaking for the year ended March 31st last shows a total revenue of £98,651, as compared with £77,030 in the preceding year. Working expenses totalled £71,347, as against £50,738, leaving a gross profit of £27,304 (£26,292). After payment of capital charges a net profit of £4,503 remained, as contrasted with £8,314 in 1919-20. The total number of units sold rose from 7,189,994 to 8,362,787. In presenting the report, the chairman of the Committee expressed his appreciation of the efforts of the electrical engineer (Mr. A. W. Blake) and his staff, which ensured the satisfactory result.

Winchester.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £17,800 for the following purposes: Plant, £11,000; mains and services, £5,600; and meters, £1,200.

Wolverhampton.—Year's Working.—We have received from the borough electrical engineer (Mr. S. T. Allen, M.I.E.E.) a copy of the annual report and accounts of the Electricity Committee for the year ended March 31st last. The total income amounted to £193,619, as against £140,830 in 1919-20, and working expenses to £119,932, as compared with £87,145, leaving a gross profit of £73,687 (£53,685). After payment of capital charges, the net result was a profit of £27,064, of which £5,000 was transferred to the Improvement Rate Fund and the balance to reserve. Last year's profit was £14,186. The number of consumers increased from 3,182 to 4,329, making total connections 23,130 kW. The total units sold rose from 17,942,935 to 21,559,351. The amount of coal per unit generated was reduced from 3.258 lb. to 3.124 lb., but the coal cost per unit sold increased from .583d. to .717d. The report shows the preference of consumers for the two-part tariff system in vogue; in fact only 4 per cent. of the total sales was effected under the flat rate system. It is proved that the former system is the more advantageous to the consumer.

Worksop.—Loan Sanctioned.—The Urban District Council has received sanction to borrow £25,000 for electricity purposes.

Wrexham.—Deficit.—In reporting a loss of £2,016 on the electricity undertaking for the year ended March 31st last, the Mayor stated that the wages of the staff had risen from £29 in 1915-16 to £140.

TRAMWAY AND RAILWAY NOTES.

Australia.—Newcastle (N.S.W.) Tramways.—The New South Wales Railway Commissioners have been asked by the Government to note the sum of £120,000 on their estimates for the next financial year as an instalment towards the carrying out of the work of electrifying the tramway system at Newcastle.—*Reuter's Trade Service* (Melbourne).

Blackpool.—Collision.—Through the wrong setting of points at Blackpool, last week, a St. Annes car collided with a Blackpool car, and a number of passengers complained of shock. The damage was slight.

Continental.—Switzerland.—The power required for the electrification of the entire Swiss railway system amounts to approximately 1.3 milliard kWh, that is to say, one-third of the present hydro-electric power output of the country. The maximum output of the power works required must be in the vicinity of 800,000 h.p. and the average output 300,000 h.p. The necessary power stations have been foreseen by the authorities of the Swiss Federal Railways and have in certain cases already been started on. Among the latter are the power stations of Ritom, Amsteg, and Barberine. After several years' investigations and studies, single-phase, 16⅔-cycle alternating current has been chosen. The Swiss Federal Railways have drawn up an electrification programme according to which the entire work of electrification will be terminated within the next 20 or 30 years. The Erstfeld-Bellinzona section of the former Gotthard line is already working electrically.—*Anglo-Swiss Review.*

In connection with the electrification of the Bernese railways the report of the works and railway authorities of Berne contains the following statement:—

"In view of the falling tendency of coal prices the intended electrification of the Berne-Neuchatel direct line and of the Emmental railways has been postponed. The price of coal has already fallen to such an extent that it is no longer practicable to face the increasing costs of electrification, and especially of electric locomotives. It is, however, to be hoped that within a reasonable period of time the cost of construction will fall sufficiently to make it possible to undertake the work of electrification and that it will then be possible to complete the proposed work."—*Financial Times.*

Cuba.—Railway Electrification.—The *Tramway and Railway World* recently described the electrification of the Hershey Cuban Railway. The original steam-worked line was 35 miles long; this is being extended to maintain service between Havana and Matanzas, a distance of 56 miles, for the transportation of sugar and other freight, as well as passengers. Including spurs, sidings, and extensions, the railway will consist of about 80 miles of track. The passenger cars will be 37.3 ft. in length, with steel underframes. Baggage and postal cars, 49 ft. in length, are also to be put into service.

Leamington.—Noisy Cars.—In consequence of numerous complaints received from residents regarding the noise made by the local tramcars, the Town Council has threatened to apply for powers to run motor omnibuses if the company does not take steps to remedy the nuisance.

London.—Cheaper "Tube" Travel.—As an experiment, the City and South London Railway commenced issuing cheap return tickets on August 15th between stations on this tube. The tickets will be issued daily (except Saturdays and Sundays) between 10 a.m. and 4 p.m., and will be available only on the day of issue. There will be a considerable saving in the fares. A return ticket from Euston to Clapham Common will be 9d., as against the ordinary fare of 1s.; between Moorgate and the Oval the fare will be 4d., as against 6d.—*Daily Mail.*

Tramcar Derailed.—On August 9th an L.C.C. tramcar proceeding to Catford left the track in High Street, Lewisham, and mounted a pavement. A cyclist was slightly injured, and one of the passengers sustained shock.

Newport (Mon.).—The Female Employe.—Defending the retention of one female employé in the tramway department when all the others had been discharged, the Chairman of the Electricity and Tramways Committee, at a Council meeting on August 9th, described her as a most valuable servant. "She carries out delicate duties in a very tactful manner," he said, "knows how to keep her mouth shut and at other times when to say 'No.' A young woman of that class is cheap to our department at 50s. a week." A motion to discharge her was defeated by a large majority.

South Africa.—Durban Strike Ended.—Durban tramwaymen, who had been on strike for two months with the object of obtaining a 10 per cent. wage increase, agreed on August 13th to resume work on the old terms, on the understanding that there would be no reduction before the end of the year.—*The Times.*

Sunderland.—Reduced Receipts.—The Corporation tramways are feeling severely the depression in trade and industry in the town, and their receipts for the past few months have been reduced by something like £300 a week as compared with the corresponding figures a year ago.

St. Helens.—'Buses as Stop-gaps.—The Corporation has decided to run motor 'buses while the tramway track is being relaid. The quotation of the Bristol Tramways and Carriage Co., Ltd., for the letting of two motor omnibuses, for a period of two months, has been accepted.

The Railways Bill.—Definition of "Light Railways."—It has been decided that for the purposes of the Railways Bill, the term "light railways" shall apply only to those light railways constructed after the passing of the Bill, and will not include the undertakings of tramway companies.

Wolverhampton.—Change of System.—The work of changing over the tramway system from surface contact to overhead collection is expected to be completed by the end of next month. Of the 12 miles of route more than half is being operated under the new system already.

TELEGRAPH AND TELEPHONE NOTES.

France.—Higher Foreign Telegram Charges.—A decree of August 4th decided that foreign telegram rates, hitherto fixed by the Telegraph Administration in gold francs, should in future be fixed in "French francs," that is to say, at the current value of the franc, which is considerably less than that of the franc at par. An average equivalent of one franc 80 centimes for the French franc as compared with the gold franc has been decided upon, though this figure is susceptible to alterations in accordance with variations of the rate of exchange. Thus a telegram to London (ten words at the ordinary rate), which formerly cost 2 francs 50 centimes, will now have to be multiplied by 1.8, costing 4 francs 50 at the new rate. A ten-word telegram to Switzerland (formerly costing 1 franc 50) will now cost 2 francs 70, and so on. The new rates came into force on August 11th.—*Reuter's Trade Service* (Paris).

New Cables.—Three new submarine cables, from Casablanca to Tangier, Tangier to Oran, and Casablanca to Oran—direct—have just been laid, says *The Times.*

Norway.—New Wireless Station.—It is reported from Christiania that a scientific expedition has left Norway for Jan Mayen Island, which lies between Norway and Greenland, where it will establish a wireless telegraph station that is to be used for meteorological service.

Riga.—A British-Baltic Postal Conference.—An International Post and Telegraph Conference opened at Riga on Monday, which was to be attended by representatives of Great Britain, Latvia, Esthonia, Lithuania, Russia, Finland, Poland, Germany, Denmark, Norway, the free Port of Danzig, and the Great Northern Telegraph Co. Questions relating to tariffs, charges, settlement of accounts, &c., will be dealt with.—*Reuter's Trade Service* (Riga).

South Africa.—Developments.—Promise is developing into performance so far as the extensions of the Union's telegraph and telephone services are concerned. The Government has allocated £450,000 for expenditure on the system during the current financial year, and we learn from the *British South African Export Gazette* that attention is also to be given once more to the installation of automatic exchanges at Durban, Capetown, Johannesburg, and other large centres. British manufacturers have now completely secured the chief position in the market which was temporarily ceded to Sweden during the war. Indeed, out of the £124,703 spent by the Government last year, the United Kingdom secured £107,505, and should have little difficulty in annexing the bulk of the £450,000 mentioned above.

In Rhodesia, as well as the Union, there are telephone and telegraph extensions in prospect, and it is confidently expected that the total of £7,991 for imports of this character last year will show an appreciable increase at the end of 1921; while, incidentally, it is interesting to note that the South-West African Protectorate is also coming into the market for supplies, though its purchases last year were worth only £1,184, the bulk of this being secured by Germany. Finally, the imports on private account amounted in the Union itself to £31,564, as compared with only £16,727 in 1919, and for the first three months of the current year to as much as £10,215. Rhodesia has not yet made its weight felt in this section of the market, but nevertheless the total of £2,368 for 1920 shows a promising advance on the £1,285 for 1919.

The Telephone Service.—Result of New Charges.—In reply to a question, the Postmaster-General informed the House of Commons that the total number of telephone subscribers who had given up the service as a result of the increased charges was estimated at 28,500, and the number of extension instruments that had been surrendered at 21,500. The rental value of those services at the new tariff would have been approximately £265,000. The number of new installations provided at the new rates was about 35,000 new stations and 30,000 extensions.

The Money Bill.—No amendments to the Telegraph (Money) Bill (which was read a second time in the House of Commons on August 7th, as reported in our last issue) were submitted to the Standing Committee of the House of Commons on August 11th, and the Bill was ordered to be reported to the House.

U.S.A.—Photography by Wireless.—A photograph has been transmitted by wireless telegraphy across the Atlantic Ocean and reproduced in Paris. The picture was a recognisable likeness, though detail and tone were lacking. The transmission was by the Berlin process from the offices of the *New York Times* through the wireless telegraph stations at Annapolis and the Effiel Tower to the offices of *La Matin* at Paris.

Wireless Developments. — The Radio Corporation of America announces that its new central stations will be opened early in September. Two of the mammoth wings or spokes of the wheel-like arrangement of the lofty antennæ towers, which we described some time ago, are complete. Twelve steel towers, each 400 feet high, compose the two wings or one operating unit. When the entire station is complete there will be twelve of these wings. The total distance between the first and twelfth towers of the completed unit is approximately three miles. In the centre of these twelve towers stands the central power house, which is now fully completed, so that in reality it will be the focus or hub of the entire system when future wings are added. Two of the 200-kW Alexanderson high-frequency alternators have been installed ready for operation.—*Reuter's Trade Service* (New York).

Venezuela.—The Maracaibo Wireless Station.—According to *Commerce Reports*, the erection of the towers for the new wireless station at Maracaibo has been completed, and the apparatus installed, so that it was expected that the station would be opened for commercial use by the latter part of June, 1921. The station is equipped with a 5-kW set with a rotary synchronous spark system. The towers are 50 metres high and the normal sending radius by day will be about 500 miles and by night about 1,000 miles.

The Venezuelan Government has already definitely arranged for seven additional wireless stations to be situated at Maracay, Caracas, Puerto Caella, La Guaira, San Cristobal, Cuidid Bolivar, and on Margarita Island. Some of these stations have already been installed by the American who holds the contract covering all the installations. After all of the above-named stations are completed, there are to be 16 additional stations installed to provide service for the capital of every State in Venezuela.

Wireless Telegraphy.—Imperial Chain.—The first completed station in the Imperial wireless chain was to be formally opened on August 18th by the Postmaster-General (Mr. Kellaway). It is situated at Leafield, near Oxford, and under normal conditions will have a range of 2,000 miles. The next station to be completed will be that at Cairo, in Egypt, which is expected to be ready before the end of the year. Construction of other stations is to be commenced next year, and in two years' time the full chain will be finished.—*Daily Telegraph*.

Wireless Telephony.—Train Control.—Experiments carried out by the Midland and L. & N.W. Railway Co.'s with wireless telephony, including the transmission of messages to drivers and guards, have shown that at the moment the use of wireless on railways is not commercially profitable, says the *Daily Mail*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—October 19th. Victorian Government Railways. Three-phase motors, starters, circuit breakers, and switches. Contract No. 34,181. (See this issue.)

P.M.G.'s Department, Queensland. October 12th. Galvanised iron and steel wire. Schedule 537, October 19th. Insulated wire. Schedule 538. (See this issue.)

Belfast.—August 22nd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries. Four water-tube boilers, with superheaters and forced-draught fans. Four fuel economisers. Two steel chimneys, with four electrically-driven suction draught fans. One electrically-driven centrifugal pump, capacity 18,000 g.p.m. (July 22nd.)

Belgium.—August 25th. Municipal authorities of Schaerbeek, Brussels. Alterations to the existing static transformer boxes and the "repartition" box, and for the construction of two additional static transformer boxes. Plans and specifications from the Caisse Communale.

September 2nd. Provincial Government of Limbourg. For the establishment of an electricity distribution system between Beeringen-Bourg Leopold, Tessenderloo, Beeringen and Zonhoven. Copies of the plans and specifications may be obtained from 99, Rue des Flamands, Louvain.

Municipal authorities of Ixelles, Brussels. Low-pressure armoured cables for the electricity supply undertaking.

Glasgow.—August 26th. Electricity Department. Works required in connection with the erection of a sub-station at Greenhead, Govan. Electrical engineer.

Horsham.—August 27th. Electricity Department. One circulating water pump, one steam ejector air pump, one water extracting pump, complete with driving units or, alternatively, a centrifugal circulating water pump, one Edwards air extraction pump, complete with driving units; 1,000 yards l.p. feeder cable, .15—.075—.15 sq. in. area; 1,000 yards 3-core pilot cable, .003 sq. in. area. (August 12th.)

September 3rd. Electricity Department. One 3-crank, triple-expansion engine, coupled to a 300-kW d.c., 460/500-V generator, or alternatively, one 2-crank compound engine, coupled to generator as above. (See this issue.)

Ilford.—September 9th. Electricity Department. Air compressor, motor and starter. (See this issue.)

India.—High Commissioner for India.—August 30th. Telegraph cable. (August 12th.)

London.—L.C.C.—September 5th. H. and l.p. switchgear for sub-station. (August 5th.)

Fulham.—September 10th. Electricity Department. A.c. motor-driven centrifugal circulating pump with pipework and valves. (See this issue.)

Paddington.—August 22nd. G.W. Railway. Three months' supply telegraph instruments, electrical apparatus, wires, cables, telegraph ironwork and tools, and drysalteries. (August 12th.)

Metropolitan Asylums Board.—August 31st. Electric lighting installation at the Grove Hospital, Tooting Grove, S.W. (See this issue).

Malta.—September 15th. Government of Malta. Single-phase a.c. meters. (See this issue.)

New Zealand.—Wellington.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

Portsmouth.—August 30th. Tramways Committee. Stores, 12 months (including insulating materials, lamps, line materials, &c.). (See this issue.)

South Africa.—Pretoria.—October 4th. Electric Light and Power Department. Coal-handling plant, 6,600-V cables, induced-draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolly Dod, General Manager, Municipal Electricity Supply, P.O. Box 423, Pretoria.

Durban.—August 31st. Corporation. One 3,000-kW, three-phase, 50-period, 6,600-V turbo-alternator wth condensing plant, circulating water pump and piping. (See this issue.)

September 28th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

Johannesburg.—November 7th. Tenders for incandescent lamps. South African Railways and Harbours. 85,560, incandescent train lighting lamps (tungsten filament) for 24 volts, 8 to 10 candle power. 8,125, engine headlight lamps, 150-watt, 32-volt (gasfilled type with concentrated filament). 50,472, incandescent lamps (tungsten filament), and 5,545, incandescent lamps (carbon filament).*

Sale.—Urban District Council. Cables, transformers, switchboards, house meters, and a.c. motors. (August 12th.)

Southampton.—August 30th. Electricity Department. E.h.p., 3-phase cable. (August 12th.)

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (August 5th.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Aldershot.—Urban District Council. Accepted:—

Met.-Vickers Electrical Co.—H.p. switchgear, £974; l.p. ditto, £780.
Bruce Peebles, Ltd.—Converting plant, £6,147. (The next three lowest tenders were: Ateliers de Construction, Belgium, £5,500; Oerlikon, Ltd., Switzerland, £5,960; Crompton & Co., Ltd., £6,056.)

On recommending the Council to accept the quotation of Messrs. Bruce Peebles & Co. (which was £600 higher than the Belgian tender) for converting plant, the engineer stated that the Belgian tender was lower because lower wages were paid in Belgium, and their quotation was for a two-bearing machine, which was cheaper than the three-bearing type made by Bruce Peebles & Co. Both tenders were for machines made under the La Cour patents; the question of obtaining spare parts was an important one. It was for the Council

to decide whether to keep business at home or to patronise foreign manufacturers. Personally, he considered they ought to stick to British manufacturers as much as possible. The Council unanimously agreed to accept the tender recommended.

Bangor.—City Council. Accepted:—
English Electric Co., Ltd.—100-kW Diesel set, £4,200.

Glasgow.—Tramways Committee. Recommended:—
R. W. Blackwell & Co., Ltd., Fleming, Birkby & Goodall.—Insulated bolts.
Wardle Engineering Co., Ltd.—Lanterns.
B.I. & Helsby Cables, Ltd.—Cab-tire cables for lighting.

Sunderland.—Corporation. Accepted:—
Ferranti, Ltd., Hollinwood.—Eighteen direct-current meters.

NOTES.

Practical Education at Manchester.—A scheme designed to give Manchester engineering students practical experience in the City Engineer's department was considered by the Town Hall Committee on August 10th. It was proposed that two or three suitably qualified men should be taken on for a two years' course during which they would pass through the drawing office and take part in work on roads, bridges, walls, sewers, and surveying. They would not be paid, but would be given a certificate at the end of the course.

The proposal is, of course, applicable to every technical department, and the Town Hall Committee, which approved the scheme, has invited opinions from the other departments of the Corporation.—*Manchester Guardian.*

A 22,000-kVA Water-Wheel Generator.—In a recent issue of the *Electrical World* was described one of the largest horizontal water-wheel-driven generators ever built. This was made for the Great Western Power Company of California. It is a three-phase, 60-cycle machine rated at 22,200 kVA, 0.9 power factor, 11,000 volts, 171 r.p.m. There will be two units of this type in the Great Meadow plant on Feather River.

The fact that it was built to operate on a 165,000-volt transmission line, the highest operating voltage to be reached so far in the U.S.A., caused some interesting features to be incorporated in its construction. Tests made at the factory on the generator show that it has 97.25 per cent. efficiency at full load and unusually high efficiencies at partial loads. These are 95 per cent. at half load and 93 per cent. at quarter load. All efficiencies were at 0.9 power factor.

The rotor consists of four separate wheels made into a single spider with the rim dovetailed to receive the poles. The machine is enclosed for ventilation, having air inlets on each side consisting of ducts coming from underneath. The heated air is expelled into the room. Some of the dimensions are as follows: Total height over all, 21 ft.; distance over the end shields, about 7 ft.; distance from the floor line to the top of the machine, 13 ft. The total net weight is 334,000 lb. The machine was built by the American General Electric Co., and is the largest ever built by that company.

Electricity on New Zealand Farms.—Addressing a meeting of Bradford wool textile manufacturers, last week, Mr. H. W. Massey, Prime Minister of New Zealand, referred to the up-to-date sheep and dairy farms in New Zealand, and spoke of the increasing use of electrical power on such farms. He said he fancied they were rather more up-to-date in New Zealand than in the homeland; they were going to provide electricity for motive power purposes for practically every industry in the country. They were developing their water powers to deal with this, and he believed that within five years every dairy farm in New Zealand having over a dozen cows would have its machinery driven by electricity.

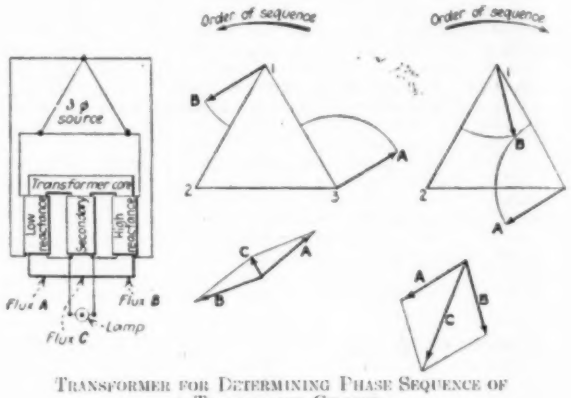
Stage Lighting.—In a new scene shortly to be introduced into "The Peep Show" at the London Hippodrome the scenery, dresses, and furniture will be "changed" by means of coloured lighting. It is claimed by the inventor of the innovation (Mr. Adrian Lamoiloff, a young Russian) that it is possible by this means to completely alter the colour, shape, and pattern of, for example, a girl's dress on the stage.—*Daily Mail.*

Indirect Storage of Power.—During the recent Chicago Convention of the National Electric Light Association an interesting plant at Vivarone, Italy, was described. This plant belongs to the Società Idroelettrica Piemonte ed Elettricità Alta Italia, and is a case of artificial storage of power. The company had a certain amount of power available during the night which it wanted to store for use during the day. A place was found where there were two lakes with a difference in elevation of 483 ft. (147 m.). On a level with the lower one, Lake Vivarone, a plant was erected and equipped with a set of motor-driven high-pressure pumps which could be used during the night to pump the water from the lower lake to the higher lake. During the day the water thus stored was discharged into the lower lake through waterwheels driving generators. From the technical point of view it worked well, but the efficiency of the whole system is very low. The calculated efficiency is 53 per cent., but the real efficiency is not more than 40 per cent.—*Electrical World.*

Testing for Phase Sequence.—In an interesting article by Prof. F. A. Kartak on "Testing for Phase Rotation in Three-phase Circuits" which appeared in the *Electrical World* for April 23rd, 1921, four methods of determining phase rotation are classified. A method devised by Mr. H. J. Blakeslee, of Hartford, Conn., which differs materially from the four mentioned in the article will be of interest to those who have to make tests of this nature. This method requires a small polyphase transformer core having two primary windings, one on each of the outside legs, a secondary winding on the common leg, and a lamp in the secondary circuit.

The ratio of resistance to reactance in one of the primary coils is made greater than the corresponding ratio in the other primary coil. The flux in the core of the former coil will, therefore, lag the e.m.f. impressed on that coil by an angle smaller than that by which the flux in the core of the latter coil lags the e.m.f. impressed on that coil. Therefore, the resultant flux in the common leg will have a value which is of different magnitude according to the phase rotation of the source, and it follows that the lamp connected in the secondary circuit will have a different brightness.

The electrical connections of the transformer are shown in the accompanying illustration, as are the approximate phase relations of the polyphase e.m.f.'s and transformer fluxes for



Transformer for Determining Phase Sequence of a Three-phase Circuit.

opposite orders of rotation. Vectors 1-2, 2-3, and 3-1 represent the three e.m.f.'s of a polyphase circuit. A represents the approximate phase of the flux in the core surrounded by the highly reactive coil. B represents the approximate phase of the flux in the core surrounded by the coil of lower reactance. A lags the corresponding e.m.f. 3-1 by nearly 90 deg. B lags e.m.f. 1-2 by about 45 deg. C is the resultant flux in the third or common leg.

The effect on the resultant flux caused by different orders of rotation is shown by the two sets of diagrams. The current in the secondary circuit naturally reacts upon the component fluxes so that their lags and magnitudes will not be identical in the two orders. There is no difficulty, however, in so proportioning the windings as to secure the effect desired.

A convenient assembly of the apparatus, including a quick reversing switch, occupies a box 6¼ in. by 4¼ in. by 2¼ in. and weighs 3 lb., thus being readily carried in a meterman's kit.

The Most Popular Lamps.—In the vacuum-type lamp the 40-watt size is used in the United States to the greatest extent, it representing about a quarter of all lamps of this class. The 25-watt is a good second, followed by the 60-watt and 50-watt. A tendency to standardise the last-named size accounts for a very perceptible increase in its use during the last two years. Meanwhile the gasfilled lamps of 75 watts and 100 watts have risen in popularity, while little change is shown in the larger sizes. It now looks as if the two sizes just mentioned will very rapidly drive out the 100-watt and perhaps the 60-watt vacuum lamps. For street-lighting work the vacuum type has virtually disappeared. The Lamp Committee brought out these facts at the recent N.E.L.A. convention in Chicago.—*Electrical World.*

Spontaneous Combustion of Coal.—Eight years after its appointment, the Departmental Committee on Spontaneous Combustion of Coal in Mines has now issued its final report (Cmd. 1,417, Stationery Office, 1s. 6d. net). It presented an interim report, however, in December, 1913, and afterwards its work was interrupted by the war. The present report, according to *The Times*, states that probably all bituminous coal is liable to spontaneous combustion in some degree, but that there is greater liability to self-heating of the coal in the seams of some British coalfields than in others is due to several causes other than the chemical composition of the coal. The thicker the seam the greater, in general, is the liability to spontaneous combustion; and coal which has been crushed in the mine by reason of superincumbent weight is more liable to self-heating than coal in a solid, compact state.

As regards systems of working, it is declared to be impossible to lay down any hard-and-fast rule for universal application. No regulations are recommended additional to those brought into force in July last, which were based on the committee's interim report.

Electric Dish Washers.—In this country the dish washer appears to be the least-known of electrical appliances, attention being devoted almost entirely to such articles as clothes-washing machines, cooking apparatus, and suction cleaners. Of course, an electrical dish washer is not exactly suitable for the small *ménage*, and this may be the reason for the apparent neglect of the appliance. The United States, however, is still working at this, and the *Electrical Review* of Chicago recently gave some particulars of two new electric dish-washing machines which have been placed on the American market. One of these, the "Autosan," is made in three sizes. The first is suitable for establishments catering for between 100 and 500; the medium size is designed for larger establishments —from 500 to 1,000 persons; the largest size is for establishments dealing with more than 1,000 persons. In this machine a rotary conveyor carries the tableware through washing, rinsing, and sterilising sprays applied from above and below; special fibre cushions are embodied in the tank to prevent chipping or breakage of china and glass. The sterilisation of the washed articles is effected by boiling water and steam. The smallest type is driven by a 1-h.p., 1,750 r.p.m. motor installed in the base of the machine, and connected to the water pumps, and, through a reducing gear, to the conveyor, thus eliminating belts or chains.

The Walker "heavy-service" dish washer is entirely different in design. It contains only one moving part, that is a blade of special design which revolves rapidly in the conical tank of the machine, and thus forces a whirling stream of water through the articles in the upper part of the tank. Four stationary nozzles in the top of the machine introduce water for washing and rinsing. A rubber knob is another accessory. Before being put into the tank, the plates, &c., are tapped against this to remove all loose pieces into a hopper. The plates are then put into trays and slid into the tank. A ½-h.p. motor has been found sufficient for the operation of this washer.

The Odometer.—The *Quest*, which will carry the Shackleton-Rowett expedition to the Antarctic, will include in her equipment, besides wireless telegraph apparatus, an odometer. The latter device, according to *The Times*, is an electrically-worked recording instrument resembling the barograph, which will be connected to the electric log and gyroscopic compass. Its function is to trace automatically on a chart the route followed by the vessel and to record her speed; it is adjustable to any chart. The odometer is the invention of Rear-Admiral E. C. Villiers, and it is believed that only three such instruments have so far been constructed.

Electric Welding in Wireless Apparatus.—Some very fine work with a small electric welder about the size of an ordinary sewing machine is described in a recent issue of the *Journal of Electricity and Western Industry*. This little machine is used in connection with the manufacture of vacuum tubes, and the work is of such a delicate nature that it has been necessary to confine it to female labour. In one type of detector is a tungsten filament surrounded by a nickel helix, and a nickel cylinder. The helix, which is composed of nickel wire .02 in. in diameter, is electrically welded to a nickel wire support. The weld is so successful that only the single support is required. The cylinder which is ¾ in. in diameter, ¼ in. long, and made of .007 sheet nickel, is supported by a .03 in. diameter nickel wire which is welded to the cylinder. The amplifying tubes are made in a similar manner. The De Forest tube is a much larger and more powerful type, and the electric welding in it shows a larger field of accomplishment, for a greater number of different metals are used, all electrically welded to each other. Within this tube, tungsten is electrically welded to dumet; nickel to tungsten; copper to nickel; molybdenum to nickel; iron to molybdenum, and molybdenum wire to tungsten, and copper to dumet. All of these metals are of very small sectional area, being under 1/16 in. in diameter or thickness. The electric welding is all of the resistance type. The delicacy of the work may be judged from the fact that the two electrodes and the wires to be welded are within an area of three-sixteenths of an inch in diameter, and this inside a "pyrex" glass tube.

Conscious after a 33,000-volt Shock.—A correspondent of the *Electrical World* states that recently, while examining some high-line oil switches preliminary to overhauling them, Charles Moore, of the Texas Light & Power Co., came into contact with a circuit and established a "ground" through his body. While he was so badly burned that he lost his right hand, he never lost consciousness, despite the fact that the circuit was operating at 33,000 volts. Mr. Moore and an assistant had been standing before the switch box, the door of which was off. Mr. Moore, it is thought, swung around to leave, and as he did so he caused an arc and was knocked down. Witnesses of the accident rushed to the stricken man expecting to find him dead, but to their amazement he began to talk towards them and intelligently directed the first-aid work himself. The discharge entered his right hand, travelled through his body, and passed through his left leg. The concrete flooring on which Mr. Moore was standing at the time clearly showed the outline of Mr. Moore's left foot, having been turned black where current passed out of his body. It is estimated that the minimum pressure which he could have received was 19,000 volts.

Energy from a City Water Supply.—We recently described an installation in a Canadian town in which the town's surplus water supply was used in the generation of electricity. In Los Angeles, according to the *Electrical World*, there is a hydro-electric installation upon the same principle but on a much grander scale. During the spring of 1919, the power shortage in this district became so acute that the power companies found it necessary to develop a source of power which could be utilised in a short space of time. It was found that by the use of water from the city aqueduct an effective head of 515 ft. could be obtained at a distance of 40 miles from the city. This distance was, however, no disadvantage as the transmission lines from another station passed the site. The water was diverted from the main aqueduct to a surge tank. From this, two riveted steel penstocks, 7 ft. in diameter and 1,430 ft. long, were erected to the bottom of the San Francisquito Canyon, wherein was constructed a power house containing two 17,500-kVA vertical turbo-alternators. The present rate of flow to these machines is 600 cu. ft. per second, and the head of 515 ft. gives an effective 30,000 h.p. The generators have a power factor of .8, they are of the "umbrella" type with directly-connected exciters and spring-type thrust bearings. Provision has been made for a third machine of this type. Upon leaving the station the water passes through a tunnel 400 ft. long and re-enters the aqueduct. The whole construction was effected in a remarkably short time. The contracts for the hydraulic part of the work were let in the spring of 1919, and awarded to the Wellman-Seaver-Morgan Co. in July. At the same time the General Electric Co. received an order for the generators. The turbines were delivered in March and April, 1920, and were put into operation on June 30th and August 7th respectively. So accentuated had the power shortage become that seven hours after water was admitted to the second unit the plant was under full load.

Railway De-control.—The control of the British railway systems, after being in the hands of the Government for the past seven years, ceased at midnight, August 15th-16th, 1921.

Educational.—City and Guilds of London Institute.—Mr. H. P. Philpot, B.Sc., A.M.Inst.C.E., Assistant Professor at University College, has been appointed to the Professorship of Civil and Mechanical Engineering at the Finsbury Technical College; and Mr. A. J. Hale, B.Sc., F.I.C., Chief Assistant in the department of Applied Chemistry, to the Professorship in that department. The entrance examination of the College will be held on Tuesday, September 20th.

Porcelain in Australia.—A deputation representing manufacturers of hard porcelain ware interviewed the Australian Minister of Customs recently to ask for increased duties to be imposed on hard porcelain ware for electrical purposes. The manufacturers contended that they were in a position to meet all local requirements, both for high and low-pressure work, and that they were installing plant (which had been made in Australia) to test up to a pressure of 150,000 volts. They desired additional protection, particularly on the general tariff, and the Minister promised to consider the request.

Copper Tempering.—Mr. Walter Bunton, of Laporte, Indiana, has discovered a process of tempering copper, which has been a lost art for many generations. Bunton found some pages of an encyclopædia in an ash heap, and read an account of how a Roman metallurgist had discovered the secret of hardening copper, but that the secret had died. He at once began experiments, which have resulted in the new process. His patent has been purchased by the United States Steel Corporation, says the *Chicago Tribune* (Paris edition), for £250,000, and a royalty of 1d. for every pound of material manufactured. The process is being kept secret until foreign patents can be completed.—*Birmingham Post*.

Wireless-Controlled Motor-car.—The first radio-controlled motor-car has appeared in the streets of Dayton, Ohio, according to the *New York Herald* (Paris edition). No one was in the car—to all appearances a conventional one 8 ft. long—yet it made its way through the main streets, obeying the traffic signals, taking the turns, and blowing its own horn at careless pedestrians. The car was driven by its inventor, Captain R. E. Vaughan, from another car following it at a distance of 17 yards or so.—*Daily Mail*.

Colouring Gem Stones.—Experiments in colouring colourless gem stones by exposure to radium emanation are being carried on at the Rare and Precious Metals Station of the United States Bureau of Mines at Reno, Nevada. A colourless Colorado topaz was tinted yellow, but the colouring was not permanent when exposed to light. If it is found that radium possesses the power to colour gem stones, the discovery will increase the commercial value of gem stone material found largely in the West, says the *Engineer*.

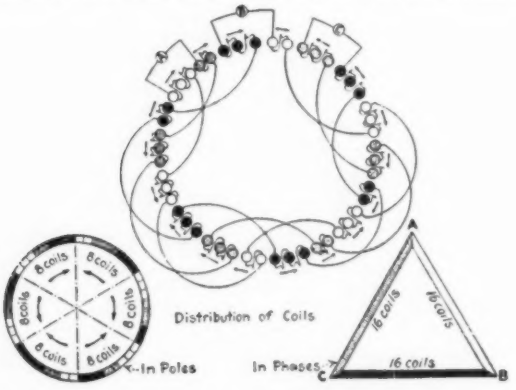
Institution Note.—Iron and Steel Institute.—The Autumn Meeting, as previously announced, is to be held in Paris from September 5th to 10th. The programme includes visits to works in Lorraine, Burgundy and Normandy. Among the papers to be read and discussed are:—"Does the critical point depend on the strength of the magnetising field?" by K. Honda, and "The situation of the French metallurgical industry in the North and in the East of France," by L. Guillet.

Appointments Vacant.—Cable jointer for the Burnley Electric Lighting Department; teachers in electrical engineering, wireless telegraphy, and mechanical engineering, for the Croydon Education Committee. (See this issue.)

Legal.—Correction.—With reference to the report of the case Electrical Apparatus Co., Ltd., *v.* J. Concord & Co., Ltd. (Elec. Rev., August 12th, p. 231), Mr. Frank W. Ward states that he did not say that he was managing director of Messrs. Burton, Griffiths & Co., Ltd. Counsel referred to him as *late* of that company.

The Ghegan Simplex Main Line Relay.—A radical departure from the time-honoured methods of adjusting the magnetic circuit of main line telegraph instruments has been devised by Mr. J. J. Ghegan, president of J. H. Bunnell and Co., New York, says the *T. & T. Age*. Heretofore this adjustment has been done by varying the distance between the magnet cores and armatures by sliding the magnets back and forth. Mr. Ghegan's method is to leave the armature and magnets in fixed positions in close proximity to each other, and vary the magnetic circuit by moving the yoke or back iron, on which the magnet spools have heretofore been permanently mounted, from contact with the magnet cores to any desired distance away from one or both cores. Mr. Ghegan's relay arrangement has some distinct advantages over the former types, such as the positive protection of the magnets and their connecting wires from mechanical injury by enclosing them in a suitable covering; simplifying the construction by eliminating sliding mechanism for the magnets, and by doing away with the back adjusting post. The instrument is decidedly quicker in action, owing to the additional break in the magnetic circuit, as well as being more responsive to small current variations, perfect work being obtained on a variation of less than 2 milliamperes over a 100-ohm leak on a 3,300-ohm circuit. This is made possible by the closeness of the armature to the magnet cores at all times, so that all lines of force go through the armature, whereas in the old arrangement of separating armature and magnet cores, besides the pull being in inverse ratio to the distance, many of the lines of force passed directly from one core to the other, and thus had no effect on the armature. The arrangement for moving the yoke or back iron is simple and ingenious, and is accomplished by turning a nut exactly as in the old style relay, so that operators do not have to learn any new adjusting methods when using the instrument.

Simplified Connections and Diagrams of Three-phase Motors.—A set of simple and clear diagrams for the reconnection of motors by ordinary machinists who were not familiar with the usual style of connections adopted in motor diagrams was desired by the manager of an important manufacturing establishment of Lima, Peru. The work was started having in mind that the diagrams to be prepared must show clearly and faithfully not only the sequence of groups, poles, and phases, but also the formation of groups. Starting at the two terminals of each coil, it was proposed to make a detailed and continuous line representation to converge at the three motor terminals. In some cases it became necessary to alter the usual style of connection so as to make practicable the reconnection in the most simple and regular way. The phases were shown differently, the terminals had to be located symmetrically, the top and bottom splicings were drawn separately,



and even the coil-to-coil stubs were clearly indicated. Among the diagrams prepared there were some for twelve, ten, eight, six, and four poles, using 2,200, 550, 440, and 220 volts both for American and German makes of motors.

The accompanying drawing is a sample of the diagrams made. It belongs to a 5-h.p., 1,150-r.p.m., 220-volt, 48-coil, series-delta, three-phase motor. Each of the small circles represents a coil. The different phases are drawn respectively clear, hatched and black. The lines issuing from the small circles represent the terminals and connection ends of the coils, and there is no other explanation accompanying the diagram than the direction to connect the motor in strict accordance with the lines joining the small circles. As the motor requires odd grouping of coils the distribution of coils in poles and phases is also indicated.—Mr. V. M. Arana, in the *Electrical World*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

The Sheffield City Council discussed at some length last week the salary of Mr. J. W. Barnes, the commercial assistant in the electricity supply department. From the speeches it appears that in August, 1919, the Council decided to pay him the amount he would have received had he been a member of the E.P.E.A. (then £630 per annum; now £702), but that resolution had never been carried out. Mr. Barnes is now a member of the E.P.E.A., and is receiving £600. One councillor said that the Council ought to redeem its promise, while another denied that the Council ever made any bargain with Mr. Barnes, and wanted to know why he should be paid £700 to-day "when the bottom of Sheffield trade had dropped out." Sir William Clegg, who said that he had always supported Mr. Barnes having £700 a year, now took up an attitude of strong opposition to any advance, and, according to the *Sheffield Independent*, he is reported as saying, "although I believe the man has been badly treated, I will not support him, as I do not approve of the methods." Sir William said that Mr. Barnes said at one time that it was not in the interests of the department that he should join the Association, but when he had failed to persuade the Council to raise his salary he changed his attitude and joined it, his avowed object being to bring himself within the Association's scale. The increase was refused by 36 votes to four.

As mentioned in our last issue, Mr. H. R. Forbes Mackay has been instructed by the City Council of Sydney, N.S.W., to visit Great Britain and America for the purpose of making himself acquainted with the latest developments in electricity supply systems. Mr. Mackay expects to arrive in London about the middle of October. He will make its headquarters at the offices of Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate. Mr. Mackay is city electrical engineer and general manager of the electricity department in Sydney. The Sydney undertaking is a big one. The capital expenditure is already near 4¼ millions sterling, and the annual revenue approximately one million. There are more than 50,000 consumers, with a total connected load of over 130,000 kW. The observed greatest demand is about 40,000 kW. For the twelve months ending May 31st, 1921, there were 12,041 new consumers connected. Mr. Mackay has reported to the Sydney Council that the next main generating unit installed, which it is proposed should be of about 16,000 kW, will fill up the whole of the space available on the site of the existing power house, and that, therefore, by about 1925 a new power house should be in operation. It is largely in connection with the design of this proposed new power house that Mr. Mackay is making his visit to Great Britain and America. He is specially interested in (*a*) The economy and effectiveness under different conditions of pulverised coal as fuel; (*b*) the automatic protection of high-pressure cables; (*c*) modern designs of high-pressure switchgear; (*d*) the latest developments in different types of automatic stokers; (*e*) steam turbines, particularly the maximum rating up to which a 3,000-r.p.m. machine can be carried with safety; (*f*) the use of extra high steam pressures in boilers, &c.; (*g*) methods of disposing of ash and clinker where coal is burned in large quantities.

On Friday, 12th instant, the staff of the Wallasey electricity department, with a number of business friends, met together in the afternoon at the offices, Sea View Road, and presented the borough electrical engineer and manager, Mr. J. A. Crowther, with a solid silver tea and coffee service as an expression of their esteem and regard, on the occasion of his retirement after 25 years' service. Mr. Starkey, the mains superintendent, by virtue of being the oldest official, made the presentation.

Owing to the resignation of the borough electrical engineer of St. Helens, Mr. B. T. Hawkins, who has been appointed by the Corporation of Wallasey, the Electricity Committee has resolved that Mr. F. N. Rendell Baker, power-station superintendent at the Corporation electricity works, be appointed acting electrical engineer for a period of twelve months at a salary of £650 per annum (inclusive).

Mr. P. J. Watts, O.B.E., first assistant electrical engineer, who has been at the head of the electrical engineering department at Sheerness yard since July 5th, 1917, as electrical engineer (acting), has been promoted to electrical engineer; and in the same department Mr. A. R. Reeves, inspector of electrical fitters, who has been employed on Admiralty overseeing duties in the Birmingham district for some years past, has been appointed second assistant electrical engineer in the place of Mr. A. E. Frankling. The promotion of Mr. Watts is to the vacancy caused by the death of Mr. A. G. Newington.

Lieut.-Col. A. K. Tasker, T.D., from the Tyne Electrical Engineers, has been posted in the same rank to the Regimental List of the Territorial Force Reserve, and Major O. M. Short and Capt. C. M. Campbell, A.M.I.E.E., of the same corps in their respective ranks, have been similarly posted to the Reserve of Officers (Territorial Force) from 26th ult. A vacancy for a captain in the Hants (Electric Lights Com-

pany) Fortress Engineers has been filled by the promotion of Lieut. K. N. Arnold, who joined the corps in 1915.

Mr. H. J. Green has been appointed switchboard attendant at the works of the Scarborough Electric Supply Co., Ltd.

Mr. H. T. W. Bowell informs us that he has severed his connection with the Silent Electric Clock Co., Ltd.

According to the Sydney *Sun*, Mr. F. B. Shenstone was entertained at dinner in July by the officers of the Chief Electrical Engineer for Railways and Tramways, on the occasion of his retirement from the position of works manager, Randwick workshops, Sydney, to take up the general managership of Messrs. Parkinson's (Australia), Ltd., who are starting works for the manufacture of electric motors in Sydney.

Sir Ernest V. Hiley, formerly Town Clerk of Birmingham, and more recently chairman of the Metropolitan Railway Carriage & Wagon Co., of Saltley, has been adopted as prospective Unionist candidate for the Parliamentary Division of Buddeston, Birmingham. The present member has intimated his intention to retire at the next General Election.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical Distribution of Yorkshire, Ltd.—Mortgage on company's undertakings authorised by various provisional orders and tolls and sums arising therefrom, and all estate, right, title and interest therein, all future undertakings which may be granted to the company during the existence of the mortgage and company's other assets, present and future, including uncalled capital, dated July 26th, 1921, to secure all moneys due or to become due from company to Barclays Bank not exceeding £25,000, including £10,000 previously secured.

Hutchinson Bros., Ltd.—Satisfaction in full on July 19th, 1921, of debentures dated June 11th, 1915, securing £2,500.

Arc & General Equipment, Ltd.—Second debenture dated July 28th, 1921, to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. D. Jones, of St. Aubyns, The Vale, Hampstead.

H. E. Ashdown (Birmingham), Ltd.—Mortgage dated July 26th, 1921, to secure all moneys due or to become due from company to London Joint City & Midland Bank, charged on certain land and premises, &c., at Perry Barr, Birmingham.

Staffordshire Electrical Accessories Co., Ltd.—Satisfaction in full on July 29th, 1921, of debenture, dated April 8th, 1920, secured £1,735 notified. Particulars of £1,735 debentures, authorised July 29th, 1921, also filed; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Chesham Electric Light & Power Co., Ltd.—Satisfaction in full on July 30th, 1921, of debentures dated July 31st, 1914, securing £25,000.

Sussex Electricity Supply Co., Ltd.—Particulars of £20,000 debentures, authorised July 22nd, 1921, and covered by trust deed of even date; present issue £10,000; charged on certain land and buildings at Crawley and company's other assets, present and future, including uncalled capital. Trustee: J. F. Drughorn.

Northampton Electric Light & Power Co., Ltd.—Issue on July 22nd, 1921, of £100 second debenture stock, part of a series already registered.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

In their report for the year ended December 31st, 1920, the directors state that many matters remain unsettled, and consequently the accounts cannot reflect the true strength of the company's position. The credit balance of profit and loss account for the year amounted to £297,682, which added to the balance brought forward, leaves to the credit of profit and loss account £1,242,134. The preference and ordinary dividends paid in January last absorbed £147,959, leaving available for distribution £1,094,175. The directors recommend payment of further dividends for the year ending December 31st, 1920, as follows: On the ordinary shares 10 per cent. (making 15 per cent. for the year), £261,108; on the preference shares 5 per cent. (making 12 per cent. for the year), £12,500, leaving as balance to carry forward £820,567. A large amount of the company's business during the past year has been with foreign countries. In consequence of the unfavourable rates of exchange which obtained during the year, substantial sums of money have been retained abroad on deposit or invested in foreign Government securities. At the end of December, when the company's accounts were closed, foreign currencies showed a very considerable depreciation, materially affecting the profit and loss account for the year. There has been a marked improvement in recent months, but the directors, believing that in the course of time a further appreciation in foreign exchanges will be experienced, regard it to be in the interests of the company that these moneys should, for the present, remain abroad. There has still been no settlement with any of the Government departments in respect of any of the company's claims arising out of the war or the services rendered during the war, therefore no sum in respect of any of these claims figures in the year's accounts. Some progress, however, has been made. An important and controlling patent used very largely by the Navy, Army, and Air Force was challenged by the Admiralty. The matter was referred for arbitration to the late Lord Moulton, who gave his award on August 2nd, 1920. He found that the patent was valid, and was infringed. The amount payable to the company under this decision has not yet been assessed. Lieut.-Col. Adrian F. H. S. Simpson, C.M.G., has been appointed a director. Annual meeting: August 24th.

Dutch Heemaf Co.

The report of the Hengelosche Electrische en Mechanische Apparaten Fabriek (Heemaf), of Hengelo, dealing with the year ended on April 30th, 1921, states that good reasons existed when the directors proposed last September to make a fresh issue of shares for 2,250,000 fl. (£187,500), as the number of orders had increased beyond expectations, and an extension of the warehousing space was necessary, having in view a growth in the export trade. During the first four months of the financial year the monthly orders averaged 1,200,000 fl. (£100,000), as compared with an average of 400,000 fl. (£33,000) in the same months of the preceding year. In November, however, a sudden and large fall in the demand for manufactures took place in conjunction with keen competition, particularly from Germany, together with a big decrease in the prices of raw materials and an unexpected increase in the delivery of the latter under then current contracts. The result was that stocks were now greater than required under existing circumstances, and it was necessary to write them down considerably. During the year the foreign sales organisation was largely extended, and good agencies having wide connections were now established in the principal countries. Having regard to the possibility of the partial electrification of the railways in Holland and the Dutch colonies in the near future, the directors considered that they ought to be active in this direction, and they had concluded an agreement with the Westinghouse Electric Co. under which they would have the right of manufacture of the principal subsidiary parts needed in connection with electric railways. After writing off 1,895,000 fl. for depreciation (of which 1,594,000 applied to stocks), as compared with 223,000 fl. in 1919-20, the accounts show a loss of 361,000 fl. This contrasts with net profits of 782,000 fl. and a dividend at the rate of 10 per cent. in 1919-20.

Chemical and Metallurgical Corporation, Ltd.

Mr. Herbert Guedalla (chairman) presided at the first ordinary general meeting on August 9th. In moving the adoption of the report and accounts, the chairman said that the estimates of technical experts, that from 18 months to two years would be occupied in bringing the process to a state of commercial utility, were being justified. The commencement of the work was undertaken at a time of general shortage and of labour difficulties, and having regard to these circumstances, the position was very satisfactory, thanks to the unremitting efforts of the technical staff. The excessive cost of coal and labour had compelled the company to devise and install special plant to cut these charges down to a minimum. The recovery process had been developed in a remarkable way; from 90 to 100 per cent. of the lead contents of complex ore could now be gained; the recovery of silver had been improved from about 30 to over 90 per cent.; and zinc recovery from 85 to over 95 per cent. The application of the process had been so improved that the treatment of lead-copper ores and the separation of lead-copper matter was well within their scope. There had been some delay in the purchase of land on the river Tees, but the delay had not proved injurious. The Francois Cementation Co., Ltd., formed by the company, had experienced a check, due to the coal dispute, but the directors considered that this company would eventually prove of valuable assistance.

Fellows Magneto Co., Ltd.

At the annual general meeting, on July 28th, Mr. V. L. Fellows (chairman) said that although the year had been one of unprecedented difficulty, the results were very satisfactory. Until towards the end of the year the demand for the company's magnetos steadily increased, and the existing plant had been taxed to its limits. The new buildings were delayed on account of the low output of labour, but they were now complete and formed a valuable addition to the factory. The shortage of raw material had necessitated a rationing system, and in consequence the company, in some cases, had received only about half of its requirements. Large forward orders had been placed when, suddenly, the demand ceased and orders were cancelled. Only by long negotiations was the company able to secure a modification of the terms upon which raw material was being purchased. Several patents, whose actual value was well in advance of their book figures, had been purchased during the year. The fall in value of raw materials accounted for a large reduction in the year's profit. A gratifying feature of the accounts was the absence of any debenture or mortgage charges, and the directors looked forward to a prosperous future. The report and accounts were adopted unanimously.

Companies struck off the Register.—The following companies have been struck off the register, and are dissolved:—

Electric Tramways of Ribeirao Preto Brazil, Ltd.

Midhurst & District Electric Supply Co., Ltd.

Rangoon Electric Tramway & Supply Co., Ltd.—The directors announce the issue of the balance of the authorised ordinary capital, amounting to 72,999 shares of £1 each, to be offered at par to existing shareholders. Any shares not subscribed by ordinary proprietors will be available for subscription by the preference shareholders. The new capital will be used to repay bankers' loans and to carry out necessary extensions. —*Financier.*

British Columbia Electric Railway Co., Ltd.—Interim dividend of 3½ per cent., free of tax, on the deferred ordinary stock.

Brompton & Kensington Electricity Supply Co., Ltd.—Interim dividend for the half-year ended June 30th on the ordinary shares at the rate of 9 per cent. per annum, less tax.

Fairbairn-Lawson Combe Barbour, Ltd.—Interim dividend on the ordinary shares at the rate of 10 per cent. per annum for the half-year ended June.

Waste Heat & Gas Electrical Generating Stations, Ltd.—Interim dividend of 1½ per cent. in respect of the half year ended July 31st, 1921, less income tax.

South Metropolitan Electric Light & Power Co., Ltd.—Dividends on the 7 per cent. cumulative first preference and 6 per cent. cumulative second preference shares.

Montreal Tramways Co., Ltd.—Dividend of 2½ per cent. for the quarter.

STOCKS AND SHARES.

Tuesday Evening.

De-control of the Home Railway companies has had little effect upon the stocks and shares of the various undertakings. So far as the steam stocks are concerned, the tendency has been to let prices go back a little, but with Undergrounds—which are, of course, less affected by the release from Government control—the market on the week is irregular. Underground Electric Incomes have recovered sharply, and are 4 points up at 81½. The shares remain about the same as they were, but of the other Underground issues, Districts and Metropolitans are lower. The recent dividend announcements of the tube lines give promise of distinctly satisfactory results being achieved over the full twelve months, whereas the outlook for the stocks of the steam companies is that lower dividends are likely to be declared, on the ordinary issues at all events, until companies get into the full swing of their own working arrangements once more. De-control may be regarded as a good thing from the point of view of the Tube stockholders, but of somewhat doubtful immediate benefit from the standpoint of proprietors of Home Railway steam stocks.

Another feature in the industrial market is the way in which Marconis have given way during the past few days. The price has gone back 5s. to 36s. 3d., which, as a matter of curiosity, is ½ under the quotation ruling for Marconis on the eve of war, though it is necessary to add that the capital has been largely increased during the period. The reason for the present depression is the fear of what the dividend announcement may turn out to be. The declaration was expected on Wednesday in this week. (See "City Notes" in this issue.) Other Marconi shares are dull in sympathy, the preference going back to 1¼, while Marines are easier at 23s. 9d. ex dividend. United River Plate Telephones are a good market at 6 3/16, and Orientals maintained their firmness at 2 1/16. The Eastern group is very quiet. Anglo-American Telegraph stocks are both better. Great Northerns have recovered to 24.

Telegraph Constructions at 21 are 5s. up. Other manufacturing shares display a good tendency on balance, English Electric ordinary and preference being, exceptionally, lower at 12s. and 14s. 6d. respectively. General Electrics are once more over par. The newly-issued 7 per cent. debenture stock has risen to 94, which is a premium of 1¼ over the price at which it came out. British Insulated hardened to 31s. 3d., Electric Constructions to 16s. 9d., but Edisons are a weak market, falling back to 9s. 6d. Henley's hold their improvement at 28s. 9d. Of the new issues, North Metropolitan 7¼ per cent. debenture is 6 premium, while Metropolitan Electric Extension 7½ per cent. debenture is difficult to buy at 8 premium. The Shropshire Electric Power 7½ per cent. ten-year convertible debenture stock hangs fire a little, and can be obtained at ¼ premium above the issue price of 97. The stock carries the guarantee, both as regards principal and interest, of the British Electric Traction Company.

This week, on Tuesday, there fell due the payment of eleven half-years' coupons, of 2½ per cent. each, upon Mexican Electric Light bonds, and Mexican Light & Power First Mortgage bonds. Upon Pachuca Fives there were ten coupons due, also of 2½ per cent. each, less tax in all cases. As the coupons were saleable in the Stock Exchange at 37¼ and 35, less tax respectively, the amounts deducted from the bonds were 26 points net in respect of the Mexicans and 23 points net for the Pachuca bonds. With the payment of these arrears of interest, there drops out the necessity for quoting any longer the certificates of deposit, and these are accordingly withdrawn from Stock Exchange lists.

British Columbia Electric Railway stocks are again in request, and the deferred at 59½ has regained the 70s. dividend deducted from the price last week. The preferred, also ex 3½, recovered 2½ points. Brazilian Tractions have dropped 1½ to 28½, which is the more singular in the face of the rapid way in which Brazilian Government bonds have been advancing on New York purchases. Some of the Indian electric lighting and traction issues are better. Southland (New Zealand) is about to offer three-quarters of a million pounds 6 per cent. debentures at 96, the money being required for electric power purposes, and the issue bearing the guarantee of the New Zealand Government.

Home Electricity shares are a good market. Rises are to be noticed in the ordinary shares of the Charing Cross, County of London, Westminster and the Metropolitan companies. London Electric preference have advanced to 2¾. On the other hand, there is a decline to 15s. 9d. in South Metropolitan preference. Notting Hill Electric 6 per cent. non-cumulative preference, of £10 each, are offered at 7½, at which price the return on the money comes to £7 17s. 6d. Dividends are due in January and July.

Engineering shares keep tolerably hard. Babcock & Wilcox at 2 7/16 are 1/16 better. Vickers have got over their dividend statement, and braced up to 11s. 6d. The rubber share-list is flat, with rubber down to 8¼d. per lb. Valorous attempts are being made to take steps that shall prove really effective in rallying the price of the produce. It is hoped that something tangible will result. Meanwhile, however, the American buyers of raw rubber decline to be stampeded into buying stocks of rubber even at the present diminutive figure.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price August 16, 1921.	Rise or fall.	Yield. p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6	—	£10 6 2
Charing Cross Ordinary	7	8	4⅞	+ ⅛	9 2 6
do. do. do. 4½ Pref.	4½	4½	3½	—	7 4 4
Chelsea	4	6	3½	—	9 4 6
City of London	13	14	1⅞	—	10 3 0
do. do. 6 per cent. Pref.	6	6	17/-		7 1 0
County of London	8	8	5⅛	+ ⅛	9 8 6
do. do. 6 per cent. Pref.	6	6	4⅜		7 7 4
Kensington Ordinary	7	9	4¾	—	10 18 4
London Electric	3½	3½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2¾	+ ⅛	10 9 8
Metropolitan	6	7	5⅛	+ ⅛	9 6 8
do. 4½ per cent. Pref.	4½	4½	2½	—	7 16 0
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	3½	—	10 13 2
South Metropolitan Pref.	7	7	15/9	—6d.	8 17 10
Westminster Ordinary	10	10	6⅛	+ ⅛	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	£5¼	+1	7 0 4
do. Def.	1½	1½	17⅛	+ ⅛	8 15 2
Chile Telephone	6	6	5¼	—⅛	5 14 3
Cuba Sub. Ord.	7	7	7⅜	—	9 6 8
Eastern Extension	10	10	16⅜	—	6 2 0
Eastern Tel. Ord.	10	10	16¾	—	6 2 0
Globe Tel. and T. Ord.	10	10	15½	—	5 19 8
do. do. Pref.	6	6	9⅛	—	6 10 0
Great Northern Tel.	23	24	24	+ ⅛	10 0 0
Indo-European	10	10	30	—	8 6 8
Marconi	25	—	1½	— ⅛	—
Oriental Telephone Ord.	12	12	2⅛	—	*5 16 8
United R. Plate Tel.	5	5	6⅛	+1/16	*6 9 4
West India and Panama	Nil	Nil	6/8	—	Nil.
Western Telegraph	10	10	16½	—	*6 1 2
Home Rails.					
Central London Ord. Assented	4	4	4¾	—	8 1 8
Metropolitan	1½	1½	25	- 1½	6 0 0
do. District	Nil	Nil	18	—	Nil
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6/6	+6d.	Nil
do. do. Income	4	2	81½	+ 4	3 13 8
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	22	—	10 0 0
do. do. 2nd Pref.	Nil	5½	2½	—	10 0 0
do. do. 5 % Deb.	5	5	64½	—	7 15 0
Brazil Tractions	Nil	Nil	28½	—1½	Nil
British Columbia Elec. Rly. Pfcs.	5	5	19	—	5 9 2
do. do. Preferred	5	4½	64xd	+2½	*8 8 2
do. do. Deferred	3	6	59½xd	+3½	*10 10 2
do. do. Deb.	4½	4½	69½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	33½	+ 1	Nil
do. 6 per cent. Bonds	Nil	Nil	25	+1½	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	Nil	51½xd	—	9 14 2
Manufacturing Companies.					
Babcock & Wilcox	15	16	2 7/16	+1/16	6 3 0
British Aluminium Ord.	10	10	17/6	—	11 8 6
British Insulated Ord.	15	15	1⅝	+1/16	9 12 0
Callenders	15	15	1 7/16	—	10 8 8
,, 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	9/6	—1/-	—
do. do. 5 per cent. Deb.	5	5	68/-	—	7 7 1
Electric Construction	10	10	16/9	+6d.	11 18 10
English Electric	8	8	12/0	—6d.	13 6 8
Do. Pref.	6	6	14/6	—6d.	8 5 6
Gen. Elec. Pref.	6½	6½	17/6	—	7 9 0
do. Ord.	10	10	20/9	+9d	*9 12 10
Henley	15	15	1⅞	—	10 5 0
do. 4½ Pref.	4½	4½	3⅝	—	6 18 6
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	11⅛	—	8 16 10
Siemens Ord.	10	10	1¼	—	*8 18 2
Telegraph Con.	20	20	21	+ ½	*5 14 1

* Dividends paid free of Income Tax.

THE RIGHT TO USE WATER FOR CONDENSING.

[By a Legal Contributor.]

In considering the question: Where shall a generating station be erected? there is one very important problem which often confronts the engineer called upon to select the site. It is: Can water for condensing purposes be procured? Even if there is water near the chosen site, whether in a stream, tidal river, or canal, it does not follow that it can be used.

Although water which is to be employed for condensing purposes need not be pure, it must be ample in amount, and, generally speaking, the manufacturer who uses it must be allowed to return it to the place from whence it came. Bearing these considerations in mind, it will be seen that there may be serious objections in the way. If the source is a tidal river, a question can scarcely arise. In the case of a canal, it is possible that the canal proprietors if allowed to do so by statute would charge but a small rent for the use of some of their water; unless, indeed, that water was used (lower down) for drinking purposes, and in that case the chance presence of a certain amount of grease in the water might make it impossible to allow it to be used for condensing.

In the case of a running river, the problem becomes much more difficult. The generating station may be erected on the banks of a stream in such a position that the company becomes a riparian owner. The question then arises whether the use of water for condensing is reasonable conduct on the part of a riparian owner, who is under certain obligations to similar owners lower down the stream.

In so far as it relates to the rights of electrical undertakers the law has recently been modified in certain particulars; but before considering these modifications let us see how matters stand at common law, and under older statutes.

In Sandwich *v.* Great Northern Railway (10 Ch. D., 707) it appeared that the railway company, whose line crossed a stream in the immediate neighbourhood of one of their stations, took water for supplying their engines and for the general purposes of the station. A mill-owner lower down the stream stated that the abstraction of water did no damage in wet weather, and never shortened the working of the mill for more than a few minutes a day. It was held, therefore, that the company, as a riparian owner, was entitled to take a reasonable quantity of water for its purposes, and that in this case the quantity taken was reasonable.

The question whether the use of water for condensing is a reasonable use of his property by a riparian owner appears never to have been decided. It is conceived, however, that if it interfered with the fish, or fouled the water, it could be restrained by injunction.

One case shows that when a plot of land on the banks of a stream is let with intent that the water shall be used, among other purposes, for condensing, the landlord must not himself heat the water by using it higher up for condensing.

In Tipping *v.* Eckersley (2 K. and J., 264) it appeared that the defendants demised to the plaintiff a plot of land, one-half of an adjoining brook, a cotton mill, reservoir, and a steam engine of 100 h.p., and the use of a weir below the mill for the purpose of holding up the water from the level of the bed of the brook at a bridge above the mill, "and the free use and enjoyment of so much of the stream of water which usually flowed down the brook adjoining the plot of land as should be necessary for effectually supplying with water and working the steam engine, or any other steam engine of like power and capacity," and covenanted not to construct any other weir or dam between the weir and bridge. Shortly afterwards the defendants erected, a little below the bridge, but above the plaintiff's mill, a new cotton mill and steam engine, with a reservoir, which drew off water from the brook between the plaintiff's reservoir and the bridge, and they discharged the heated water which they had used for their new mill into the brook, whereby on one occasion they raised the temperature of the water which the plaintiff had to use for condensing purposes from 57 deg. to 68 deg. It was also deposed that in consequence of the increased temperature the plaintiff's engine worked nearly half a stroke a minute less than the usual rate of 28 strokes a minute. Upon a motion for a decree the Court granted a perpetual injunction restraining the defendants from discharging heated water, so as to increase the temperature of the water which the plaintiff used for condensing purposes, being of opinion that the evidence, exclusive of that as to the actual diminution in the working of the engine, showed a material interference with the quality of the water to which the plaintiff was entitled under the demise.

The use of canal water for the purpose of condensing has often been expressly recognised and sanctioned by Act of Parliament, on the ground that such use must of necessity encourage the erection of mills near the canal. Where such use is authorised the statute will be liberally construed in favour of those who have the right to condense. Thus in Rochdale Canal Co. *v.* Radcliffe (18 Q.B.D., 287) a company was established by statute for making and maintaining a navigable canal, and by a section reciting that the erection of steam engines near the navigation might promote its interests it was made lawful for the owners of lands within 20 yards of the canal to draw off sufficient water to supply such engines for the sole purpose of condensing, such water to be returned into the canal (allowing for inevitable waste) so that no obstruction should be caused to navigation. The company sued the defendant on the ground that, being possessed of land within 20 yards of the canal, and of a mill and steam engine on such land, he drew water from the canal more than sufficient for the sole purpose of condensing, and used it for purposes other than that of condensing. The defendant, in his defence, alleged that he was a tenant of the land, and was the occupier of a mill abutting on the canal and of a steam engine, and that he and all occupiers of the land, mill, and engine, had for 20 years used as a right the easement of drawing from time to time from the canal such quantities of water as were necessary for other purposes than that of condensing—such as supplying the boilers of the engine, generating steam to heat the mill, cleaning the boilers, and supplying water to a cistern on the roof of an engine-house on the land. A mill of the defendant called the Old Mill, with a steam engine, abutting on the canal, had existed for more than 20 years; but within 20 years a new mill with another engine had been erected adjoining and communicating with the old mill, water passing from one to the other. The machinery of one mill was worked by power from the other, and the water of the canal had been used in both mills for most of the purposes mentioned in the plea. The jury found that the buildings constituted one mill, and a verdict was taken for the company. It was held that the use of the mill was justified, and that in so far as there had been excessive use there should be nominal damages for the canal company.

Where a mill-owner is entitled to use water for condensing purposes, he may well be tempted to use it for steam raising. If he does so, and the canal company acquiesce, it seems that he may acquire a right. In another case, by a Canal Act, the owners of steam engines on the banks were empowered to lay pipes and take water from the canal for the purpose of condensing steam. In 1830 K. built a steam engine and laid pipes to the canal with the cognisance of the canal company, and, until the year 1847, when disputes arose, used the water for the purpose of raising as well as condens-

ing steam. An action was brought by the company which recovered 1s. damages. The defendant continued to take the water, and the company filed its bill, praying that he might be restrained. The defendant, by his answer, produced and alleged evidence that the company was aware, when the mill was built, that the water would be used for raising steam. Although the company's right had been established at law, the Court at the hearing held that the company was bound by its acquiescence, and refused a perpetual injunction to restrain the defendant from taking water for the purpose of "generating steam." An injunction, however, was granted with regard to another mill, acquiescence and encouragement on the part of the company not having been established.

With regard to tidal waters, it is conceived that there could be no objection to a riparian owner making use of the water unless restrained by the port authority acting under the provisions of some statute.

We now come to the point at which the legislature has intervened.

The Electricity (Supply) Act, 1919, confers very important rights on those who are responsible for the supply of electricity. By Sec. 15 of this Act the Ministry of Transport on the representation of the Electricity Commissioners may by order authorise any Joint Electricity Authority or any authorised undertakers to abstract water from any river, stream, canal, inland navigation or other source, and to do all such acts as may be necessary for the purpose of enabling the Joint Electricity Authority or authorised undertakers to utilise and return the water so abstracted, subject to such conditions as may be specified in the order. The Board, however, cannot in any case make such an order until notice of its intention to make the order has been given by advertisement or otherwise as the Board may direct and an opportunity has been given to any person, who appears to the Board to be affected, to state any objections he may have thereto, and such order may provide for the recovery in a summary manner of penalties for infringement of the order.

The reference to a "special order" in this section involves that an inquiry must be held before the rights of riparian owners are interfered with by an order made in pursuance of the Act. At such an inquiry a riparian owner might put forward such objections that the Ministry of Transport could reject the scheme and refuse the order.

Where the source from which the water is to be abstracted is a canal, inland navigation, or harbour, or where any existing rights of riparian owners will be affected, the order authorising the abstraction shall be a special order, and shall provide that the water not consumed shall, subject to any agreement to the contrary, be returned at a level not lower than that at which it was abstracted.

The order must also require that all water not consumed (and in no case less than 95 per cent. of the water abstracted) shall be returned in a condition not less pure than when it was abstracted, and at a temperature not higher than such as may be specified. The temperature is to be fixed at such a degree as appears necessary to avoid injury to public health or to fisheries, if any, or in the case of a canal or inland navigation to the works thereof, or to vessels using the same, or to the trade or business carried on by any person using the water for the purposes of or in connection with his trade or business. Finally, no order can be made authorising the abstraction of water from any dock regulated by Act of Parliament except with the consent of the owners.

We are not aware than any order has yet been made in accordance with these provisions. Some nice questions are sure to arise when the words "not less pure" have to be considered. Does this mean that no water which shall be used for condensing must be contaminated with the least trace of oil? Again, the question of temperature may create difficulties where the water abstracted from the stream or river forms a considerable part of the whole. Expert evidence will have to be adduced to show how far, if at all, fish life is affected by raising the temperature of water to any material extent.

CARPETS AND THE ELECTRIC SUCTION CLEANER.

By F. FRENCH KEMP.

[In the course of a recent article on electric suction cleaners, the author commented adversely on the use of a brush driven by the motor, in conjunction with the exhaust fan. The following article, which has been written by a dealer in oriental and antique carpets, presents arguments in favour of the brush, from his point of view.—Eds. Elec. Rev.]

The great increase in the sale of electric cleaning machines during the past few years has led to the production of so many and various types, that the retailer who handles these appliances must, in his own and his customers' interest, deliberate very carefully before deciding to adopt a particular make. Inasmuch as the primary function of these machines is to clean carpets, and it is by their efficiency in this operation that they should be mainly judged, the opinion of one who has for years been engaged in the sale of antique and oriental rugs and carpets, may be of some help.

To a dealer in antique carpets the problem of thorough cleaning without damage to the fabric and the delicate pile is one of primary importance. These carpets, when received by us, are generally in a very dirty state, and the first step to be taken by the dealer is to have them cleaned. Oriental carpets also, when first imported, are full of sand, which likewise needs removal. Now the old method of carpet cleaning was to send the carpet away to be beaten by steam or shampooed, but in the case of antique carpets, which frequently come to us after 100 years or more of use, such a process was quickly found to be unsatisfactory. The carpets certainly returned clean, but the injury caused to their delicate fabric was irretrievable. In some cases hardly anything but the bare foundation was left.

We were, therefore, forced to seek some method of cleaning which would be equally thorough, but not destructive, and we decided to test the capabilities of electric suction cleaners. Superficially the results were very encouraging. The surface of the carpet was rendered beautifully clean, the dust-dimmed colours regained their beauty, and no injury was done to the carpet.

But close study of the carpet cleaning problem had taught us that there are three kinds of dirt in carpets. First, there is the surface dust; secondly, surface litter, such as crumbs, hairs, threads, &c.; and thirdly, most destructive of all, dirt deeply trodden into the material of the carpet. This last kind of dirt, apart from the insanitary condition which it produces, is ruinous to carpets. It is the cause of those ugly, bare patches which necessitate many an otherwise beautiful carpet being prematurely relegated to the lumber room. For amongst this dirt are particles of sharp-edged grit. Ground in by constant foot pressure, these sharp pieces of grit soon sever the threads, and the pile thus detached leaves behind the bare foundation of the carpet.

Now, though the surface dust was quickly removed by suction, a close inspection of the carpet revealed the fact that the other two kinds of dirt were still left behind. Hairs and threads still adhered obstinately to the surface, while, more important still, the destructive grit was left behind embedded in the fabric. After

repeated tests, we were driven to the conclusion that suction alone could not clean with the thoroughness which was essential; but its advantages were so obvious that we decided to make further investigations on these lines.

It was at this juncture that our attention was called to a type of machine which, besides making use of suction, embodied a motor-driven brush, and an inspection of this machine at work decided us to give it a thorough trial. Its method of operation seemed extremely simple. The revolving brush, driven by the electric motor, possesses two rows of spiral bristles. As the carpet is lifted off the floor by suction, the first row of bristles strikes and depresses it. Again the suction lifts it, and the second row of bristles depresses it. It will be seen, therefore, that the constant repetition of this process is equivalent to a gentle beating of the carpet while suspended on a cushion of air. At the same time, of course, the brush sweeps the carpet, so that here was a machine combining three processes—beating, sweeping, and suction cleaning.

Exhaustive tests of this machine proved to us conclusively that in this simple addition of a motor-driven brush to a powerful suction cleaner lay the solution of our carpet-cleaning difficulties. The closest scrutiny of the texture of a carpet after it had been cleaned by one of these machines failed to reveal dirt of any kind. All the clinging threads and hairs, all the deeply-embedded dirt, had vanished and the carpet was ready to pass inspection by the most critical buyer. It seems to us impossible to over-estimate the importance of the motor-driven brush in securing this result. The suction cleaner pure and simple keeps the carpet suspended all the time it is being cleaned; whereas we found that it was the alternative raising and depression due to the impact of the brush which shook loose the embedded dirt, and so gave the suction a chance to operate. Surface matter also, which had adhered too firmly to the surface to be removed by suction unaided, had been swept up by the rapidly revolving soft hair bristles. In short, this type of machine seems to us to be the logical result of experience; it combines effectively the new process of suction cleaning with the old methods of beating and sweeping.

It must be borne in mind that the fabrics we were dealing with were oftentimes of an extremely delicate nature. We had to satisfy ourselves, therefore, that repeated cleaning by this machine would in no way injure the carpet. In this connection perhaps it will be sufficient for us to say that for years now we have used nothing else but this machine on every kind of carpet, some of them over 200 years old, and that the experience thus gained enables us to state definitely that this process is absolutely harmless to even the most delicate material and, in our opinion, a regular grooming by such a process, which removes the destructive embedded grit, must tend to lengthen the life of carpets very considerably.

It has been stated that a motor-driven brush is inclined to injure the pile of carpets—a misunderstanding which has arisen probably from the fact that some makes of carpets, when new, contain a certain amount of loose pile. This is due to the fact that when the final process of clipping the pile takes place, some of these clippings are left behind. By wetting the thumb and drawing it across the surface of the carpet, it will be found that some of this loose pile adheres to the wet skin. In other cases also, the sharp pieces of grit cut the pile, which then lies about loose. Needless to say, the motor-driven brush machines will remove this, but its removal is essential in order to obtain the longest possible life from this species of carpet. To leave these soft clippings in means that they become matted with dirt and grit, the ruinous consequences of which we have seen.

To summarise the results of our experience, we would unhesitatingly advise dealers in these appliances to recommend to their customers a machine which embodies the principle of a motor-driven brush. Many carpet owners are ignorant of the very existence of beneath-the-surface dirt embedded in the material, and still more so, of its destructive effect. It can only be extracted by beating, and for this purpose the inclusion of a motor-driven brush combined with powerful suction is effective and essential.

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(*Concluded from page 229.*)

The Relation of Run-off to Rainfall.

By H. Lapworth, D.Sc., M.Inst.C.E. (*Abstract.*)

The relation of run-off to rainfall is extremely complex, and though many data have been published of late years with regard to the flow of British streams, the accuracy of some of the figures is open to question.

A study of 29 different streams in Britain yields the result that the mean annual loss (evaporation) may range from minus 2 in. (or gain) to 28 in., the average being a little over 14 in., while 18 out of the 29 observations show average losses between 11 and 17 in.

The evaporation from land surfaces increases with increase of rainfall, both regionally and in the same watershed. While our British records are too uncertain and variable to enable one to trace this regional law, it certainly appears to hold good in individual British streams. The mean annual evaporation increases by about 7/10 in. for each degree (F.) increase in the mean annual temperature. The influence of vegetation (especially with regard to forests) on rainfall, evaporation, and stream flow regimen is still a vexed question.

No investigation of stream flow regimen can be satisfactory unless the factor of ground water storage be taken into account, and assumptions that the distribution of flow in dry years will be similar, or that the monthly losses will be identical with those in normal years, may be seriously misleading. Owing to the dual nature of stream-flow, that is, a surface or flood flow superimposed upon a discharge of ground water, it would seem that casual stream-gauging, unless covering a fairly dry year, is apt to be of less real value than is usually supposed, except in so far as the average annual loss and the average dry-weather flow is concerned. The dry weather or spring flow is derived almost solely from ground-water storage, and is a factor of the greatest importance.

The extreme dry-weather flows in this country appear to range from zero in very small gathering grounds and areas of low rainfall to 1 or more cusecs per 1,000 acres in areas of previous rocks or of high rainfall. In relatively impervious gathering grounds with average annual rainfalls of between 40 and 50 in., the extreme dry-weather flow is generally found to lie between 1/10 and ¼ cusec per 100 acres. The dry-weather discharge is higher in areas of pervious than of impervious strata, and that the dry-weather flow increases with the rainfall is certainly the case in individual gathering grounds, though when we study the minimum summer flows from many different watersheds in relation to the average rainfall, no obvious connection is apparent.

The maximum rates of flood-discharge appear universally to have no relation to the mean rainfall, and in Britain our heaviest storms and floods appear to take place in areas of least rainfall.

For British upland impervious gathering grounds the late Mr. P. à Morley Parker recently proposed the formula $Q = 500\ M\ 5/6$, where Q = rate of maximum flood discharge in cusecs and M = area of gathering ground in square miles.

Mechanical Appliances and Labour in Loading and Unloading Ships' Cargoes.

By A. Musker, M.Inst.C.E. (*Abstract.*)

This note indicates how much more mechanical appliances could be used, and shows how many docks lack up-to-date methods in this respect.

For example, in the London docks over 3,000,000 tons of coal per annum are raised from barges by means of crude steam winches and boilers; the coal being shovelled by hand into wickerwork baskets. Some large appliances are used for this purpose, but being unwieldy and difficult to move from dock to dock, they only do a small portion of the work required.

A visit to any ordinary dock shows a fearful lack of mechanical appliances which could take the place of manual labour, and the loss of time one sees owing to the men having to wait on one another is appalling. To keep up-to-date and handle warehouse goods economically, warehouses, if not suitable, should, like old machinery, be scrapped.

A striking instance of what could be done is shown by the appliances used in handling goods at the Port of Manchester warehouses, where they have overhead cranes, electric trucks, conveyors, stacking machines, and numerous others. Why should not electrical trucks be used in place of hand trucks? and why should not careful attention be paid to the floors over which they have to run? On the other hand, why should not ordinary wheel trucks, to carry about 10 or 15 cwt., be fitted with ball bearings so that each load lowered by the crane could be moved to its destination by one man, instead of its being split up into hand-truck loads of, say, 2 cwt., one man to each? With a reasonably smooth floor and a well designed truck, 20 cwt. can be easily moved by one man. Even in the slings used for lifting the goods there is a want of attention to detail; one sees almost every lift sling used about 8 or 10 ft. too long, which means that the crane, as a rule, lifts 8 or 10 ft. higher than is necessary, probably wasting 25 per cent. of the power used.

The discharge of frozen meat is an important item, and although in some cases conveyors are used, it is to a very limited extent; the continuous conveyor, as against the intermittent crane system, might be extended with considerable advantage as regards economy in time and labour.

Discussion.

Opening the discussion on Mr. Musker's paper, Sir Arthur Trevor Dawson, Bart., who presided, considered that they were far from being up to date as a country in their loading and unloading appliances.

Sir John Aspinall, who followed, thought it nothing less than astonishing to see the apathy displayed in this country regarding the handling of cargo, and instanced Liverpool, where even now there was no crane capable of lifting a ton from a ship and placing it in the warehouse. With rapidly working electric cranes one could do the work so quickly, Sir John said, that the position of the goods did not matter.

In his remarks, Mr. Scrutton said that the old-fashioned methods of handling cargoes had completely broken down. New ships of great capacity had put the hydraulic crane and the hand truck out of court, and more up-to-date appliances must take their place.

Mr. Davis referred to the method of handling cargo at Liverpool as being of the most elementary kind.

Exhaust Steam: Its Employment for Power, Heating, &c.

By E. R. Dolby, M.Inst.C.E. (*Abstract.*)

Steam which has passed through a prime mover may vary in pressure from that of the atmosphere to 60 lb. per sq. in. or even higher. In non-condensing engines about 90 per cent. of the heat which is contained in the steam entering the engine is discharged with the exhaust; also in the condensing engine or turbine, about 60 per cent. of the total heat in the fuel burned passes to waste with the cooling-water effluent from the condenser. The total heat units from water at 32 deg. F. in a lb. of dry saturated steam at 150 lb. gauge pressure is about 1,194, while in exhaust steam at 1 lb. gauge pressure it is about 1,147.

The most efficient utilisation of the thermal value in coal cannot be obtained until there are sets of public mains provided by the community for public utility. One set of the mains might receive electric energy in the form of alternating current at a standard pressure and frequency; another set might receive steam at a pressure of from 5 to 10 lb. per sq. in.; while a third set would deliver water at a temperature of from 180 deg. to 200 deg. F. The electric energy, steam, and hot water, would be by-products from scattered installations comprising prime movers driven by steam.

The subsidiary electric mains would be coupled to the existing public supply mains, as is now the case on the north-east coast of England, the consumer being paid for what he delivers and charged for what he consumes. The steam mains would furnish direct heating in radiators, drying-chambers, and calorifiers for the supply of domestic hot water, and wherever practicable the condensate would be drawn back by an air-pump to the starting point. Such mains are common in the United States, although rare in Great Britain, where, however, several large blocks of buildings in Manchester are supplied with exhaust steam from an electric generating station. The hot-water mains would convey water heated in exhaust steam calorifiers and circulated by pumps. In some instances steam mains would be preferable, while in other cases hot-water mains would be better.

The subject may be divided under the following headings:—

Class I.—Power only Required.—1. If steam be employed solely for power purposes with a fairly steady load and condensing engines are used, then the saving of the thermal loss in the condensing water may be obviated by eliminating the condenser, providing steam at a somewhat higher pressure, and discharging the exhaust at, say, 5 lb. back pressure into a public steam main. Electric power from the public mains might in some cases be substituted with advantage.

2. If the load is intermittent, such as that of colliery winding, hauling, &c., the exhaust may be passed into an accumulator and thence into an exhaust steam turbine. If extra power is not required, this turbine can be used to drive an alternator and the energy delivered to the public electricity mains. The heat loss in the condensing water could be obviated by omitting the turbine and discharging from the accumulator to the public steam mains.

Class II.—Power and Other Uses.—1. If the other uses require steam at about atmospheric pressure only, then steam engines or steam turbines may be used for power only, or for electric energy also; they would be non-condensing, and the exhaust at a back pressure not exceeding 1 lb. would be taken into the private heating mains, and an air pump used on the return. Steam at this temperature would not boil water, but it could be used for drying, air heating, water heating, and in radiators.

2. If rapid boiling or high-temperature heating be necessary, the stop-valve pressure would be selected so that the necessary power could be obtained from the prime mover within the assumed fall of pressure. With steam turbines several different "pass-out" pressures may be selected, say, 60 lb. for cooking the raw product, and from 15 to 30 lb. for heating the drying cylinders. If reciprocating engines were used they would be of the simple type exhausting at the highest back pressure desired.

The methods of allocating charges to the various purposes for which the heat is employed are often fallacious. The author is of opinion that the thermal units employed for each service should be charged to that service, and that all costs of labour, fuel, stores, taxation, interest, and sinking fund should be charged *pro rata* on the thermal units consumed by each service.

Enormous savings can be effected by using back-pressure on reciprocating engines, employing "pass-out" steam turbines, and utilising apparatus to employ the heat in the exhaust steam. The cost of electric energy can in many cases be reduced well below the rates charged by public authorities. It must, however, be borne in mind that much private electrical generating plant in works, and also in public institutions, has been removed, even although the whole of the exhaust steam was usefully employed. This has occurred particularly in London, but in most of these cases the high cost of labour, the necessity for three shifts of stokers, and the high costs of secondary battery maintenance have been the deciding factors in the removal.

MAGNETIC STORMS:

Their Effects upon Railway Signal and Telegraph Apparatus.*

The effects of magnetic storms on railway telegraph apparatus, such as single needle, Morse, duplex, quadruplex, and telephone single-wire circuits, have been noticed on very many occasions, rendering signalling almost impossible.

Records of the value and direction of these currents have been taken by some railway companies, notably the Midland Railway Telegraph Administration. But the difficulties in obtaining actual measurements in the cases of tablet or block circuits are very great, owing to the fact that the circuits are mostly isolated, and in the majority of cases practically impossible to get at, to take measurements while the storm is on. Further, it is not desirable to interfere with these circuits at such times any more than is necessary.

Fortunately, local circuits have not been so frequently interrupted by these currents as through or long circuits have. This, however, depends upon the intensity of the magnetic storm. The severe magnetic storms during 1919-1920 were strong enough to generate currents sufficient to affect many local or comparatively short circuits, such as signal arm repeater circuits, which are considerably under one mile in length. In all cases inconvenience and delay have been caused, but if tablet, staff, block, or lock and block instruments are interfered with, the consequences may be serious.

Through the kindness of the engineer-in-chief of the Post Office and various railway companies' telegraph engineers, in supplying measurements and particulars, the author has prepared tables, which show the extent and importance of the subject.

The currents actually measured on railway signal and telegraph circuits vary from 8 to 33 milliamps, and voltage from 13 to 53 volts. The interference is not due altogether to the earth's magnetic field acting magnetically on the armatures or needles of telegraph apparatus, as in the case of s.n. telegraph instruments, if the circuit is disconnected the needles tend to return to normal. There may be some influence magnetically due to the variations in the earth's field, but the major part of the interference is due to currents in the circuits.

The currents passing over the wires during magnetic storms may be due to one of many causes, for instance:—

1. The effect of the energy discharges from the sun may be to raise the potential of the earth itself electrostatically at one point (or area) above the surrounding areas, and in the endeavour to establish equipotential, currents flow through the earth and every other conductor that offers a convenient path.

* Abstract of paper read at the Institution of Railway Signal Engineers (Inc.) by Mr. W. J. Thorrowgood, signal and telegraph superintendent, London & South-Western Railway.

The author has calculated that the total currents passing through the earth between observing stations (the distance between which varies from 3 to 350 miles) may be anything from 5 to 225 amperes.

2. The effect may be due to the changes in the earth's magnetic flux (in or surrounding the conductor) acting inductively on the wire. This view necessitates a continual alteration in the magnetic lines of force, or flux, across the conductor to maintain the potential difference, and the author gives the absolute value of the earth's magnetic field and rate of change per second to generate the currents observed. He also gives the strength of the earth's magnetic field per sq. cm. in the area enclosed between the surface of the earth and the wire above the surface of the ground.

3. It may be that the ions driven off from the sun bombard, as it were, the earth at certain parts, the conducting wires become electrically charged at that place, and the electricity passes to earth over the conductor. It may be that the electricity flows from the charged spot towards both ends of the wire to earth at the same time, thus there may be two currents in the circuit passing in opposite directions from the charged part.

The currents due to magnetic storms on August 11th, 1919, and March 22nd, 1920, caused a release or false clear indication to be received on practically every form of block, lock and block, tablet, staff and block bells in use on English railways, but there is no case recorded where a signalman actually acted upon the false signal, although it is obvious that he was free to do so had he disregarded the block instructions.

A summary of the Post Office records of currents due to magnetic storms between August 1st, 1919, and April 1st, 1920, a period of eight months, during which 18 magnetic storms, or an average of 2.25 per month, were recorded, is given in the original paper.

On ten days the observed currents were 25 m-A, or over, to 56 and 150 m-A on March 23rd, 1920, which may be called dangerous magnetic storms, or 1.25 per month on an average.

The areas over which the magnetic storms are experienced are very great. On August 11th, 1919, magnetic storm effects were felt all over Great Britain and Ireland, and the maximum current values observed varied from +150 to −60.

The merit of the author's tables is that the records of the currents and e.m.f. recorded, have actually been measured during magnetic storms, and the resistances measured.

The special feature concerning the magnetic storm on August 11th, 1919, was its sudden appearance and its effects upon comparatively short circuits (such as signal arm repeater circuits) which had not been noticed previously; a current of 50 m-A was recorded on a circuit 13 miles long between Ambergate and Mansfield. A summary of the record of the number of days the earth's magnetic field was disturbed and the comparative extent of the daily disturbances during the years 1918 and 1919, shows that the number of magnetic disturbances vary from year to year. In 1918 disturbances were observed on 211 days; on 13 days the disturbances were great, and on 8 very great In 1919 on 253 days magnetic disturbances were recorded; on 21 days the disturbance was great, and on 18 days very great; thus in 1919 there were 2.25 as many days when the magnetic disturbances were "very great" than in 1918. During the magnetic storm in August, 1919, the declination of the earth's magnetic field varied from 13° 44′ W. to 15° 49′ E. The vertical force varied 935y. The north force varied 840y. During the storm in March, 1920, the declination varied from 13° 35′ to 14° 54′. The vertical force varied 820y. The north force varied over 810y.

Circuits having no connection with earth (that is, having metallic returns) are practically immune from the effects of currents due to magnetic storms. Mr. Stevenson, of the Caledonian Railway, states:—

"None of our block, train tablet, or train signalling telegraphs were interrupted in any way, as they are practically all now on return wire circuits," although some of the s.n. telegraph circuits on that railway were disturbed to a certain extent. The records show that some metallic circuits have been affected, but very slightly, compared with the effects observed on earth-connected circuits.

The complete and safe remedy therefore appears to be to provide metallic returns for all circuits. This does not of necessity mean that a return wire will have to be provided for each circuit, as a common return wire can be used for all circuits over certain lengths, but the distance between the conductor and return should be as little as possible. It is best to sectionalise common return wires, owing to the difficulty of tracing faults, also to the lowering of the insulation resistance of the whole of the circuits, when only one common return is used over a large area. If a common return wire is provided the resistance of the instruments should be as high as possible.

The currents due to magnetic storms or stray earth currents may be reduced by increasing the resistance of the circuit and keeping the sensitiveness of the electric signalling instruments the same as at present. The question arises what value of resistance should be added to the circuit to ensure that any magnetic storm current would not affect the apparatus? Probably 200 per cent. increased resistance would give a sufficient factor of safety to render the circuit safe from dangerous interference. It would, of course, be necessary to increase the battery power at each station to correspond with the increased resistance to give the working current for the instruments on the circuit.

It may be put forward that owing to the infrequency of magnetic storms the expense of providing return wires would not be justified, but there is a danger that, owing to their infrequency, a false signal given by a magnetic storm may not be recognised immediately.

A third method of lessening the effects of magnetic storm currents would be to issue special regulations to signalmen, and rely upon the men to notice any irregular working of the aparatus.

TELEGRAPHY AND TELEPHONY IN THE UNITED STATES.

The annual report of the Telegraphy and Telephony Committee of the American Institute of Electrical Engineers reviews telegraphy, telephony, and radio-communication during the Institute year 1920-21, and according to the *T. & T. Age*, points out that the technical developments of the past year have placed the telegraph and telephone departments of railroads in the United States and Canada in a more serviceable condition than they have heretofore been.

The employment of recent types of telephone repeaters has been arranged for on a number of the large railroads for the purpose of improving long-distance telephone service, and the subject of stronger pole lines has been given serious attention on many railroads. On some lines the factor-of-safety plan of construction has been extended. During the year the increase in telephone lines has not been great, due mainly to retrenchment following temporary business depression, but tests have been made with wired radio, under the direction of Major-General Squier, and the practice of welding joints in exposed lines has been extended.

The application of automatic printing telegraph systems to commercial requirements is being extended, both in the United States and Canada. For trunk circuits carrying heavy traffic, the multiplex system is being widely applied, by which it is possible to handle eight hundred or more messages per hour over a single conductor, correct incidental errors instantly, and have every message ready for delivery to the addressee as soon as it has passed over the wire.

A new field being entered by printing telegraphs is that including private branch offices, and way-office circuits. A promising use for this system is its employment by commercial concerns and industrial establishments for intercommunication purposes and for communication between business offices and telegraph offices. Start-stop systems are satisfactory, their use is being extended, and they are operated duplex over distances of 300 miles without intermediate repeaters. The employment of repeaters permits operation over greater distances. Simplex printers are operated at a speed of about fifty words per minute.

Considerable progress has been made in applying printing telegraph systems to submarine cables. Further improvements now being made will result in much simplified equipment with promise of an increased output in unit time.

No radical changes have recently been made in the character of devices installed on communication lines for protection against lightning disturbances, but promising progress has been made during the year toward the solution of the problem of inductive interference control and reduction. Prominent among the efforts towards more systematic treatment of the problem are facilities inaugurated by the National Electric Light Association for centralised study by a committee and engineering staff specialising in this subject. The trend is clearly toward co-operative study and treatment. There has been no outstanding development during the year in the form of specific devices or methods applicable, but the American Telephone and Telegraph Co. has developed and given some preliminary field use to a new type of "noise meter," designed to measure the degree of disturbance indicated in a telephone receiver without bringing in the personal factor of the observer in judging equivalent noise as is the case with the older "noise" standard employed by the telephone companies.

During the year there was in general a continuation of refinement in the design of automatic telephone apparatus. So far as radically new developments are concerned no epoch-making inventions have been disclosed, but progress has been made in standardisation and the standardisation of nomenclature resulted in the publication of about one hundred definitions of current terms.

There have been placed in service three devices which may have an important relation to the further development of the art:—

1. The call indicator, used in calling from an automatic office to a manual office during the period of mixed working, which displays the call number before the operator and permits automatic exchange subscribers to dial all numbers.

2. A calling device number plate with office names in addition to numbers, to permit retention of office names in small multi-office exchanges converted to automatic operation.

3. A calling device number plate with the alphabet in addition to the numerals to enable the first few letters of the office name to be used as numerals in a large multi-office exchange.

At the Midwinter Convention of the Institute a paper by Messrs. Colpitts and Blackwell described the carried systems which have been developed and put into commercial use in the Bell telephone system.

The commercial telephone installations described give four added circuits over each pair of line wires in addition to the usual telephone and telegraph facilities provided by the wires. Commercial telegraph systems provide as many as ten added duplex telegraph circuits, also in addition to the usual facilities. The apparatus involved in such systems is necessarily complex, and therefore expensive, so that systems of this type are in general economical only for comparatively long circuits.

Radio-communication during the past year has undergone a reorganisation of ownership of the important patent rights which should relieve a very complicated situation and result in placing in use equipment superior to that heretofore employed. The radio companies are now in a position to proceed without imminent fear of infringement of essential patent rights.

The superior serviceability of continuous waves, with beats reception, has been recognised, and spark transmitter systems, for all but ship emergency uses, are no longer planned for commercial operations. There is a strong legislative sentiment in favour of more liberal regulations. The sentiment that favours greater freedom in wave-band selection also favours the enforcement of more rigid requirements of purity of radiation and the securing of minimum damping at transmitting stations.

A broadening of the field is noticeable in adapting radio to new uses, and several such applications are looked for in the immediate future. The remote control of switches by means of radio is now being considered.

The superheterodyne method of reception, due to E. H. Armstrong, stands out as an important contribution of the past year.

The progress of radio-telephony during the past year in all its phases is illustrated in a radio-telephone toll circuit now in commercial operation in the territory of the Pacific Telephone & Telegraph Co., furnishing telephone service between the Island of Santa Catalina and the wire network of the mainland centring in California. The circuit is operated according to wire line methods. he radio section is between coastal stations 32 miles apart. The circuit is provided with through line ringing of a type which is free from interference, and a superposed telegraph circuit capable of forming a link in a duplex wire telegraph circuit. The transmission and quality over the circuit are of such high standards that it is regularly connected, when required, into the long-distance telephone circuits. The extensive application of electric wave filters in transmitting and receiving circuits has made it possible to obtain a good quality of speech and at the same time to secure greater selectivity than was possible with the prior art. The use of loops for receiving and of shorter wave lengths for short distances has to some extent reduced interference.

A sub-committee of the Standards Committee of the Institute has been engaged in the work of formulating standard definitions of terms most commonly used in telegraphy, telephony, and radio signalling.

Consideration has been given to bringing about agreement so far as is practicable between English-speaking countries, and the sub-committee is co-operating with the British Engineering Standards Association, with the above-mentioned object in view.

Considerably greater attention is now given in American universities and technological schools to instruction and research work in communication engineering.

REVIEWS.

Coil Ignition for Motor Cars. By C. Sylvester, A.M.I.E.E., A.M.I.Mech.E. Pp. xii+228; figs. 106. London: Sir I. Pitman & Sons, Ltd. Price 10s. 6d. net.

The subject of ignition in motor-car engines is particularly interesting from the fact that exactly opposite practice is found as the standard system on either side of the Atlantic, coil ignition in America and magneto ignition in England and on the Continent. Opinions differ widely as to which system will prevail and as to the merits of each; consequently a book with the above title appearing at this juncture has great scope for a wide appeal, and should be full of interest. One naturally expects to find a full discussion of the case, all the arguments set out clearly for and against each system, a well balanced opinion of the problem stated and the reasons for it given. After that one might expect to see the various steps in the evolution of coil ignition traced, and all the important inventions noticed, especially as regards this country. All the differences in the use of coil and magneto ignition might be brought to notice, together with the latest refinements in coil ignition practice from America.

Unfortunately, in this case one is largely doomed to disappointment. A third of the book is taken up in the first two chapters, called "Introductory" and "Equipment Testing," with instructions to the "chauffeur-mechanic" on elementary electrical principles, the care of dynamos and motors, &c. Full details are given and illustrated of such operations as undercutting the mica on commutators, sanding-in brushes, &c., and much space is devoted to testing armatures with a millivoltmeter. It is recommended that £50 be spend by every car owner on electrical testing instruments for his garage. In the preface we are told by the author: "Every owner of a motor car should obtain a copy of this work. He should give it to his chauffeur, who is sure to appreciate it." Also the remark is made that when a fault occurs in the electrical system the chauffeur generally scratches his head instead of laying his hand on the fault. He is supposed to start reading the book with his electrical knowledge at zero, and arriving at page 15 is confronted with the following: "To commence a simple description of induction one cannot do better than quote Faraday's Law. This is to the effect that 'An electromotive force is induced in any circuit when the magnetic flux linked with the circuit changes in value, the magnitude of the induced electromotive force being proportional to the rate at which the magnetic flux linked with the circuit changes.'" One can imagine the "chauffeur-mechanic" indulging in a considerable amount of head scratching at this point.

Chapter III is taken up with detailed instructions about making a trembler type induction coil. A new trembler is described which gives a spark described as being "more juicy" than others. By this time the "chauffeur-mechanic" has presumably become a "chauffeur-electrician-mechanic." And Chapter IV deals with the ignition system, a point where the book might well have begun. The usual hydraulic analogy appears, and then some examples of Delco interrupters, wrongly called distributors, are given. A good modern form of interrupter is shown on p. 106, and a clear circuit diagram on the next page, the remainder of the chapter dealing with faults in the ignition system interspersed with a description of an automatic cut-out on the lighting system.

Chapter V is called "Coil Ignition Systems in Use," the first 42 pages being devoted to descriptions of Delco apparatus as produced in the years 1912—1920. The Delco system is stated to be almost the standard system in America—a fairly large claim. Are such names as Remy, Atwater-Kent, Connecticut, Westinghouse, and Wagner entirely negligible? The C.A.V. and the Mira systems are described, the latter being a peculiar kind, in which the coils and contact-breaker rotate, thereby losing one at least of the advantages of coil ignition.

The remainder of the book consists of wiring diagrams of Delco lighting, starting, and ignition installations as used on ten American cars, very few of which are well known in this country, with comments on these diagrams.

It is curious as the author is such a strong believer in the future of coil ignition, that he does not gather together all the claims for this system, and put forward a strong case, for there is no doubt that an attractive appeal can be made out by a skilful counsel. Instead he merely mentions a few points in favour of coil ignition incidentally, while describing the apparatus, and assumes that magneto ignition is dead and almost buried. Now, considering the fact that 96 per cent. of this year's British cars rely on magneto ignition, and approximately the same proportion of Continental cars, this is a pretty large assumption. The author several times gives his opinion that coil ignition will very soon become the standard system here as in America. Does he realise that in some well-informed quarters the opinion is held that the only reason why coil ignition is used so much in America is because that country has never yet been able to produce a really good magneto? Coil ignition undoubtedly has points in its favour, and one would have expected to see all of them brought out, and the whole subject thoroughly ventilated in a book with this title. Perhaps the most remarkable fact concerning coil ignition in this country is that the Wolseley Co. has adopted it on some if not all its new cars. That so well-known a firm, rather conservative in its habits, should have taken this step is a very noteworthy incident, but is not mentioned in the book under review. Neither is there any notice of two very interesting pieces of apparatus connected with the history of coil ignition. One of these is the ingenious Atwater-Kent open-circuit type contact-breaker used on enormous numbers of cars in recent years; the other is the unique and very scientific form of coil ignition invented by Sir Oliver Lodge which might well have become general if the high-pressure magneto had not been commercially developed just about the same time. Two other notable omissions are the Conner coil system, which has some specially interesting features, and the Rotax, as installed on the Cubbitt cars.

The book is well printed on good paper, and there is a pleasing absence of misprints. F. H. H.

Armature Winding and Motor Repair. By Daniel H. Braymer. Pp. vii+515; figs. 298. New York and London: McGraw-Hill Book Co. Price 18s. net.

This book is intended by its author to be a practical treatise for the benefit of those engaged in the manufacture, operation and repair of electrical machinery. In the preface, the author disclaims any intention of dealing with the theoretical side of his subject, but, as a matter of fact, he does give a considerable amount of information on the theory of winding, as becomes inevitable in describing the various types and arrangements of armature coils.

Perhaps it is impossible for a book of this kind to be quite complete, but some of the omissions are of such importance,

that attention should be drawn to them. The squirrel-cage winding of induction motor rotors, and the closely allied damping windings of alternating-current machines, have caused manufacturers and users probably more anxiety than any other single detail of design. The problem, of course, is to make a stronger joint than is possible by soldering, and although riveting, brazing, and welding have good points, in this particular application they also have their bad points, and finality has certainly not yet been reached. The author had ample scope for telling the practical men how to approach this thorny question, but he dismisses the whole subject of squirrel-cage rotors in ten lines, with a single illustration of a cast construction, now discredited for all except the smallest sizes. Another example of inadequate treatment is to be found in the reference to turbo-alternators. A big percentage of the generating plant in this country and America is now of the direct-coupled steam turbine type, and before long the percentage will be still higher. The winding of the stator calls for the greatest skill and care, and the author quite rightly devotes a special section to this work. Difficult, however, as the stator may be, the rotor of the modern turbo-alternator is still more difficult, and only specially trained and experienced men can deal with it satisfactorily. It is, therefore, an important and curious omission on the part of the author to make no reference whatever to the rotor. The section dealing with varnishes is very incomplete, and the question of insulation generally receives inadequate treatment. The author indicates the use of mica for the insulation of large machines, but for machines of small and medium output, he recommends such unsatisfactory materials as duckcloth, pressboard, fish paper, and Empire cloth for parts for which mica would now be used in this country. We have to remember, however, that this is an American book, and the use of mica on the other side of the Atlantic is not so general as here. From the winder's point of view, winding jigs play a big part in the universe, and it is disappointing that the author has made only very casual reference to such an important item. The author makes clear reference to the importance of symmetry in the windings of armatures for direct-current machines, but he ignores the subject altogether when dealing with alternating-current machines. The omission is important for the reason that it is possible to have a winding symmetrical without a commutator that would be unsymmetrical if a commutator were connected. It is to be regretted that the author confines himself to giving rules for determining symmetry, instead of giving the fundamental definition that the voltage in parallel circuits must be identical at any instant.

The author does not always make his meaning clear. For instance, what will be the state of mind of the student who refers to the book to find the correct section to employ for equalising connections and reads the following?

"Equalising rings should have an extremely low resistance. Such practice requires not only an excessive amount of copper, but leads to considerable loss and heating in the winding. All that is really necessary is to provide an alternative path of negligible resistance compared with that of the brushes, and for this purpose it is usually sufficient to make the section of the rings about half that of the conductors."

The least satisfactory part of the book lies in the extensive quotations from articles, and from manufacturers' catalogues and instruction pamphlets. The illustrations are plentiful and good; the printing also is good, and there are few misprints. The book can be recommended to practical men, students, and junior designers, for, although each of these three classes of readers will find the subject treated inadequately from their point of view, nevertheless the book does contain a great deal of information and is free from incorrect and misleading statements.

Electric Power Transmission. By Alfred Still. Pp. xviii+ 407, 136 figs. London: Hill Publishing Co., Ltd. 1919. Price 17s. 6d. net.

Prof. Still's work, published in 1913, on "Overhead Electric Power Transmission" is now expanded by the addition of an important chapter treating of underground conductors. The author's object, in issuing a second edition of his useful work, is stated to be that of making it more suitable for use as a college text-book; but the constructional engineer in charge of erection work, for whose use the first edition was intended, will find the value of the book in no way diminished by its increased field of utility. Since the new chapter has been written with the assistance of Mr. C. J. Beaver, the matter contained in it is sure to be reliable, and thoroughly representative of modern practice.

The book opens with a list of the symbols employed, a practice we should be glad to see all authors adopt. Some of them are used for several different purposes, such as R, which has four meanings when used without a suffix, and four more when used with one. Some are not quite up-to-date, as k.v.a., instead of kVA, but as it has only recently been realised that there *are* standard symbols, we refrain from doing more than drawing Prof. Still's attention to the matter.

There is little to add to our review of the first edition, but we think it is worth mentioning to an author of Prof. Still's knowledge and experience, both as an engineer and as a writer, that the production of books for use as college texts, while very necessary, and to that extent desirable, is not the highest aim a clever engineer, even if he is engaged in teaching, can set before himself. The present volume, as we have already said, is excellent, but we could point to others, one at least by Prof. Still, which bear every sign of having been written between lectures. The student at college needs feeding with theory and up-to-date accounts of the practice obtaining, but the man in the field, on the job, feels the need more frequently than seems to be generally appreciated, of looking up the theory of the subject with which he is dealing, and so carrying out his work more intelligently. The field to be covered in the electrical industry is so enormous, and the really good books are so few, that, in the language of the day, it is "up to" those who can write, and who have the knowledge, to do what they can to supply the deficiency.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JULY, 1921.

An improvement occurred in the export total during July, the figure being 29 per cent. above the June total, although it must be remembered that the latter was low on account of the coal dispute. There was a substantial increase in electrical machinery, but by far the largest advance was in submarine telegraph and telephone cable. Imports fell by about 30 per cent., the principal decreases being in the items "Glow lamps" (75 per cent.), "Batteries," "Meters," "Carbons," and "Telegraph instruments and apparatus." The total of re-exports was increased by the re-appearance in the third column of "Telegraph and telephone wire and cable," other items, with the exception of "Electrical machinery," showing decreases. Further information showing the increases and decreases for the month, and for the seven months, is given in our "Business Notices" to-day.

Values of Electrical Exports and Imports for July, 1921.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£148,081	£40,176	£3,250
Insulated wire	180,853	10,816	210
Glow lamps	34,711	9,742	312
Switchboards (not telegraph or telephone)	24,645	243	—
Arc lamps and parts	401	4,343	—
Batteries	51,534	4,470	—
Meters	51,891	3,699	762
Carbons	3,285	3,094	1,314
Electrical machinery:—			
Railway and tramway motors ...	25,417	—	—
Other motors and generators ...	252,654	—	—
Electrical machinery (unenumerated)	129,883	55,921	4,267
Telegraph and telephone cable and material:—			
Telegraph and telephone wire and cable (not submarine) ...	135,327	7,768	3,416
Submarine telegraph and telephone cable	338,208	—	—
Telegraph and telephone instruments and apparatus	188,655	30,401	3,511
Totals... ...	£1,565,545	£170,673	£17,042

The total weight of electrical machinery exported during last month was 1,496 tons, as compared with 863 tons in 1920 and 2,035 tons in 1913; for the seven months ended July, 1921, 1920, and 1913 the total weights of electrical machinery exports were 11,231 tons, 5,641 tons, and 15,820 tons respectively.

Estimated Cost of Hydro-Electric Transmission.—An estimate of the cost of building a new hydro-electric plant of 6,000-h.p. rating, and 66,000-volt lines from the station to other points on its system, has been prepared by the New England Power Co., and is published in the *Electrical World*.

The estimate is for doing this work during 1921 and 1922. It is based upon the company's extensive experience in hydro-electric plant and line construction in central New England, and assumes wooden-pole lines and a generating station operating under a head of about 245 ft. and producing about 25,000,000 kWh per year. The proposed dam is to be from 30 ft. to 40 ft. high. The figures are summarised below:—

Preliminary and general expenses, $36,000; dam, $70,000; spillway, $73,000; outlet, $8,000; conduit, $598,500; surge tank, $13,000; penstock, $26,200; power-station building, $36,000; power-station equipment, $222,000; engineering and supervision (5 per cent.), $54,300; total, $1,137,000

Transmission lines: Length 6 miles, $35,521; length 9.5 miles, $69,900; length 21 miles, $163,220; total, $268,641.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,289. "Magneto electric machines." F. L. Hollister. July 28th.
20,292. "Maintenance of high vacua in closed vessels." General Electric Co. July 28th.
20,296. "Electrically controlling bodies at a distance." A. W. Loth. July 28th. (France, July 29th, 1920.)
20,299. "Control for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.) and General Electric Co. July 28th.
20,334. "Construction of ceramic vessels with electric heating." A. Steinhardt. July 28th.
20,345. "Device for effecting magneto timing of internal-combustion engines." L. C. Allen. July 29th.
20,360. "Dynamo electric machines for motor vehicles." H. Foxton. July 29th.
20,361. "Electric switches." F. B. Cox. July 29th.
20,368. "Electric horns." W. J. Spicer and T. S. Rogers. July 29th.
20,369. "Electric horns." W. J. Spicer and T. S. Rogers. July 29th.
20,380. "Electric kettles, &c." B. C. Joseph and N. C. Joseph. July 29th.
20,384. "Telephone systems." Western Electric Co. July 29th. (United States, September 25th, 1920.)
20,391. "Apparatus for measuring distance between two wireless stations." A. C. Spreadbury. July 29th.
20,395. "Electrolytic cell." C. J. Thatcher. July 29th.
20,402. "Electric foot battery." E. Rickards. July 29th.
20,406. "High-frequency inter-valve transformers." A. E. Greenslade. July 29th.
20,407. "Printing machines." British Thomson-Houston Co. Ltd. (General Electric Co.) and General Electric Co. July 29th.
20,419. "Electric furnaces." H. G. Lemoine. July 29th. (France, July 29th, 1920.)
20,422. "Electric standard lamps, portable radiators, fans, &c." C. Elphick. July 29th.
20,435. "Electric flashlamps." Schwabe & Co. July 29th. (Germany, March 1st.)
20,437. "Method of increasing output of gas from electrolytic apparatus." E. Vesme. July 29th.
20,443. "Electric transmission." A. M. Taylor. July 30th.
20,446. "Interlocking devices for electric switches." E. J. Brothers and Tucker & Co. July 30th.
20,467. "Methods of controlling electric lighting circuits." E. Booth and N. R. Booth. July 30th.
20,468. "Resistances." E. Booth and N. R. Booth. July 30th.
20,469. "Conduits for electrical conductors." E. Booth and N. R. Booth. July 30th.
20,503. "Electric gramophone." O. P. Petersen and A. E. Wells. July 30th.
20,504. "Electrode insertion for mercury vapour arc rectifiers of glass." E. Marschner. July 30th.
20,506. "Sparking plug." J. Nairn. July 30th.
20,545. "Electrically operated warning horns." R. W. Maudslay, and Standard Motor Co., Ltd. August 2nd.
20,565. "Electric calling devices." T. Lenaghan. August 2nd.
20,567. "Microphones." W. K. L. Dickson. August 2nd.
20,574. "Commutator for motor car engines." G. L. Coppin. August 2nd.
20,594. "Electric switches." R. Alkan. August 2nd. (France, March 19th.)
20,595. "Speed regulating devices for electrically-driven vehicles." Associated Equipment Co., Ltd., and D. E. Batty. August 2nd.
20,605. "Electric stockings, socks, &c." L. P. d'Hainaut. August 2nd.
20,624. "Electric fuses, &c." F. A. Ross. August 2nd.
20,629. "Electric control of indicators." J. E. Dannah. August 3rd.
20,638. "Wireless control of vessels." T. F. Wall. August 3rd.
20,644. "Control of alternating current electric motors." W. Brooke and E. M. Kerr. August 3rd.
20,659. "Electrical and mechanical safety lock for lifts." W. H. Cozens. August 3rd.
20,666. "Electric player for pianos, &c." J. Lawler. August 3rd.
20,672. "Telephone systems." G. Deakin and Western Electric Co., Ltd. August 3rd.
20,683. "Electric switches." R. F. Paiton. August 3rd.
20,688. "Insulating structures for high-potential condenser terminals, &c." W. Dubilier. August 3rd. (United States, February 18th.)
20,699. "Electric magneto switches." British Thomson-Houston Co., Ltd. (General Electric Co.). August 3rd.
20,701. "Electrode for electric welding, &c., and method of making same." S. H. Gordon. August 3rd.
20,704. "Sparking plugs." Armstrong Sparking Plug Co., Ltd., and J. H. Im Thurn. August 3rd.
20,712. "Electric switch for converting two lamps from parallel to series lighting." P. F. Godfrey. August 3rd.
20,738. "Spark plugs." S. Brown. August 4th.
20,761. "Electric switches." C.L.I. Manufacturing Co., Ltd., and E. A. Watson. August 4th.
20,763. "Electric ovens." A. Selvatico. August 4th.
20,764. "Communtating apparatus for electric commutator machines." Siemens Schuckertwerke. August 4th. (Germany, August 9th, 1920.)
20,770. "Electrically operated switch machines." W. H. Simms (General Railway Signal Co.). August 4th.
20,790. "Antenna systems for wireless signalling." Ges fur Drahtlose Telegraphie. August 4th. (Germany, August 6th, 1920.)
20,793. "Mercury motor meters." A. E. White (Sangamo Electric Co.). August 4th.
20,800. "Wireless signalling, &c." T. F. Wall. August 5th.
20,813. "Magneto-electric, &c., machines." R. Bosch Akt-Ges. August 5th. (Germany, August 23rd, 1920.)
20,835. "Screw grip tongues for electric lamp holders." G. E. Tolson. August 5th.
20,836. "Electric shade breakage preventer." G. E. Tolson. August 5th.
20,841. "Directional wireless apparatus." J. Robinson. August 5th.
20,855. "Electric light device." H. J. Redmond. August 5th.
20,861. "Oil cooled transformer boxes." Akt-Ges Brown, Boveri et Cie. August 5th. (Switzerland, August 5th, 1920.)
20,868. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 5th.
20,874. "Spark plugs." W. B. Bronander. August 5th. (United States, February 11th.)
20,878. "Electro-magnetic gearing." W. L. Baynham. August 5th.
20,904. "Illuminated advertisements." W. Beck. August 6th.
20,922. "Electric current limiting devices." W. F. P. Fanghaenel. August 6th.
20,925. "Electric heating." H. Harrison. August 6th.
20,927. "Electric resistance furnaces." B. H. Thrupp. August 6th.
20,928. "Glands of electric joint boxes." C. J. Beaver and E. A. Claremont. August 6th.
20,930. "Electric switching devices for telephone, &c." Relay Automatic Telephone Co., Ltd. August 6th. (Sweden, September 8th, 1920.)
20,935. "Electric testing and measuring instruments." F. L. Castle and General Electric Co., Ltd. August 6th.
20,942. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 6th.
20,943. "Telephone systems." H. Baron (F. Aldendorff). August 6th.
20,950. "Synchronism apparatus." E. M. C. Tigerstedt. August 6th. (Denmark, August 7th, 1920.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

6,165. "Electro-magnetic devices for maintaining in motion rolling bodies." Magerle and Martinek. June 16th, 1913.

1918.

13,476. "Ignition device for internal combustion engines." A. Press. June 11th, 1917. (166,503.)

1919.

1,392. "Electro-magnetic wave signalling arrangements." F. Lowenstein. January 19th, 1918. (122,640.)
21,067. "Operating mechanism for electrical generators and magnetos." Splitdorf Electrical Co. January 16th, 1915. (131,899.)
21,503. "Telemotor apparatus." W. J. Paulin, T. C. Fortune, and T. McLeod. September 2nd, 1919. (166,591.)
21,714. "Electrical switches." E. Dobson and Foster Engineering Co., Ltd. September 4th, 1919. (166,592.)
23,801. "Wireless telegraphy and wireless telephony and the like." S. Brydon and A. G. T. Cusins. September 27th, 1919. (166,594.)

1920.

2,521. "Electrical heater or warming device." D. Lyon. (October 23rd, 1920.) (166,603.)
3,930. "Electric aural apparatus more especially for use by deaf persons." S. G. Brown. October 25th, 1920. (166,610.)
4,714. "Electric transformers." Hackbridge Cable Co., Ltd., and W. C. Kennett. November 4th, 1920. (166,613.)
4,916. "Junction box for electric wiring systems." J. C. White. February 18th, 1920. (Cognate application, 7,106, 1920.) (166,615.)
6,986. "Telephone transmitters." Miessner Inventions Corporation. March 12th, 1919. (140,070.)
7,614. "Arc lamps." A. H. Railing and A. E. Angold. December 14th, 1920. (166,627.)
7,851. "Wireless transmitting circuits employing thermionic valves." A. K. Macrorie, H. Morris-Airey, G. Shearing, and R. L. Randall. March 16th, 1920. (166,634.)
8,833. "Thermionic valve circuits for wireless telegraphy and telephony." A. J. Macrorie and G. Shearing. March 25th, 1920. (166,640.)
9,648. "Telephone apparatus for deaf persons." G. L. Jonasson. April 6th, 1920. (166,641.)
9,899. "Combined electric switch and meter for use on motor cycles and the like." F. E. Wilson, W. A. Shepherd, and Powell & Hammer, Ltd. April 8th, 1920. (166,649.)
9,900. "Electro-magnetic cut-outs." F. E. Wilson, W. A. Shepherd, and Powell & Hanmer, Ltd. (166,650.)
9,963. "Electric step-by-step motors of the unwound armature type." Barr and Stroud, Ltd., and J. W. French. April 9th, 1920. (166,651.)
10,068. "Electrical measuring instruments of the moving coil type." R. F. Hamilton & Co., Ltd., F. S. J. Pile, R. F. Hamilton, and H. Smith. April 10th, 1920. (166,653.)
10,105. "Electrical switching apparatus of the kind comprising a conducting liquid jet." J. F. G. P. Hartmann. April 10th, 1920. (166,654.)
10,187. "Metal vapour electric apparatus." Siemens-Schuckertwerke Ges. March 4th, 1915. (141,705.)
10,241. "Electrical energy distributing systems." J. W. Goodman. April 13th, 1920. (Cognate application 16,148, 1920.) (166,656.)
10,299. "Electric muffle furnaces." Automatic & Electric Furnaces, Ltd., L. W. Wild, and E. P. Barfield. April 13th, 1920. (166,659.)
10,404. "Multiplex high-frequency electrical signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 14th, 1920. (166,662.)
10,477. "Mounting of electric motors on machines." W. Asquith (1919), Ltd., and G. Feather. April 15th, 1920. (166,667.)
10,644. "High-frequency dynamo-electric machines." British Thomson-Houston Co., Ltd. June 22nd, 1915. (141,745.)
10,646. "Electric lamps." W. R. Bullimore. April 16th, 1920. (166,675.)
10,760. "Sparking plugs." K. E. L. Guinness. April 17th, 1920. (166,680.)
10,996. "Inter-communication telephones." H. J. Palmer and Telephone Manufacturing Co., Ltd. April 20th, 1920. (166,700.)
11,018. "Railway signalling apparatus." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. April 21st, 1920. (166,703.)
11,072. "Arrangements for obtaining substantially uniform electric currents from pulsating currents." Siemens-Schuckertwerke Ges. November 15th, 1915. (142,116.)
11,078. "Storage batteries." J. A. Law (A. P. Smith). April 21st, 1920. (166,707.)
11,080. "Electrical relays." Igranic Electric Co., Ltd., and F. Bergmann. April 21st, 1920. (Cognate application 2,562, 1921.) (166,708.)
11,117. "Electro-magnetic chucks or work holders." J. Zehnder & Sohne. April 22nd, 1919. (142,123.)
11,184. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd., J. Martin, and F. H. Clough. April 22nd, 1920. (166,715.)
12,352. "Devices for cooling electric machines." P. Ehrmann. April 4th, 1919. (142,828.)
13,042. "Means for producing alternating currents." British Thomson-Houston Co., Ltd. (General Electric Co.). May 11th, 1920. (166,760.)
13,702. "Process for the production of formate of ammonium from barium cyanide." Norsk Hydro-Electrisk Kvaelstof-Aktieselskab. May 26th, 1919. (143,850.)
13,836. "Maximum demand controller and load indicator for electric power installations." D. F. Campbell and C. G. Gow. May 19th, 1920. (Addition to 121,312.) (166,774.)
14,043. "Wireless directional systems." J. Robinson and R. T. Smith. May 21st, 1920. (166,780.)
15,258. "Telephone systems." Western Electric Co., Ltd. January 27th, 1919. (144,320.)
16,550. "Sparking plugs." C. Zorzi. August 28th, 1918. (145,450.)
17,103. "Electric arc lamps." H. Jackson, June 24th, 1920. (166,805.)
17,413. "Electro-magnetic wave receiving and transmitting arrangements." Soc. Francaise Radio-Electrique. November 3rd, 1916. (146,204.)
19,512. "Device for strengthening telephone currents and other electric oscillations." Ferdinand Schuchardt Berliner Fernsprech und Telegraphenwerke. April 20th, 1917. (147,579.)
19,790. "Armature construction for dynamo-electric machines." V. G. Apple. November 19th, 1914. (147,771.)
20,891. "Thermionic tube relay arrangements." M. Latour. September 27th, 1915. (153,319.)
29,333. "Polarisers of polarimeters, saccarimeters, and such like instruments." A. Hilger, Ltd., W. E. Williams, and C. F. Smith. October 18th, 1920. (166,842.)
32,477. "Drawing-in tape for threading electrical wires in conduits." T. W. Nixey. November 17th, 1920. (166,853.)
35,867. "Recording phonographs." Telegraphon, Ges. January 10th, 1920. (157,076.)

1921.

15,928. "Alternating current electricity meters." S. Z. de Ferranti, G. Wall, and Ferranti, Ltd. January 17th, 1920. (Divided Application on 165,133.) (166,869.)
15,929. "Direct current electricity meters of the mercury motor type." S. Z. de Ferranti, G. Wall, and Ferranti, Ltd. January 17th, 1920. (Divided application on 165,133.) (166,870.)